4.4 Idaho Nuclear Technology and Engineering Center

Situated in the south-central portion of the INL, the Idaho Nuclear Technology and Engineering Center (INTEC) has been in operation since 1952 and historically has been a uranium reprocessing facility for defense projects. Irradiated defense nuclear fuel was processed to recover unused uranium. After fuel dissolution and extraction, high-level liquid waste was stored in stainless steel underground tanks in the tank farm. The high-level liquid waste was calcined, and the resultant granular solids (calcine) were stored in stainless steel bins encased in thick concrete vaults. In 1992, DOE announced that the reprocessing component of the INTEC mission would be phased out. This decision led to the phaseout of all fuel dissolution, solvent extraction, product denitration, and other related processes at INTEC. Other missions have included research, storage of spent nuclear fuel, and waste management.

Past disposal practices, once considered acceptable, have been found to be potentially detrimental to the environment. Over past decades, radioactivity and other contaminants from INTEC processing plants and support systems have been released to surface and subsurface environments. Perched water exists in basalts and sedimentary interbeds at INTEC at depths ranging between 100 and 420 ft below ground and has been contaminated by downward transport of COCs. The aquifer was impacted by operation of the INTEC injection well, which was used to directly dispose of service wastewater to the subsurface environment from 1952 to 1986. Although these operational releases would not meet current standards, they did meet rules and standards of the times.

Cleanup activities at INTEC will include DD&D of facilities, RCRA closures, actions driven by the VCO, and CERCLA remedial and removal actions. INTEC is designated as WAG 3 in the FFA/CO and includes two OUs (OU 3-13 and 3-14). OU 3-13 includes all sites within INTEC with exception of the tank farm and the Snake River Plain Aquifer inside of the INTEC fence line. A ROD for OU 3-13 was signed in 1999. The enforceable date for the OU 3-14 ROD is May 31, 2010.

Risk assessment information for INTEC OU 3-13 is documented in the following reports: *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)* (Rodriguez et al. 1997), *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part B, FS Report (Final)* (DOE-ID 1997b), and *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part B, FS Supplement Report* (DOE-ID 1998b). With the exception of the tank farm, INTEC is currently being remediated under *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (hereinafter referred to as the OU 3-13 ROD) (DOE-ID 1999b). The majority of INTEC CERCLA remedial action information provided in this section is derived from this ROD or the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)* (Rodriguez et al. 1997), which preceded the ROD. Other sources of information related to INTEC include the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* (hereinafter referred to as High-Level Waste Environmental Impact Statement [HLW EIS]) (DOE 2002b) and the *Performance Management Plan* (DOE-ID 2002b).

An *Explanation of Significant Differences for the Final Record of Decision for the Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 2004f) documents changes to portions of remedies selected in the OU 3-13 ROD. Based on further evaluation, three sites (CPP-81, CPP-82, and CPP-61) were designated as No Action sites. The CPP-23 (injection well) site also was further evaluated by the agencies using both existing information and new monitoring data after issuance of the OU 3-13 ROD (DOE-ID 1999b). Based on this evaluation, the scope of the OU 3-13 Group 5 remedy has been expanded to include the CPP-23 site.

4.4.1 Current State

The current mission of INTEC is to receive and store spent nuclear fuel and to store and treat radioactive and mixed waste.

There are approximately 290 facilities in the plant area. The types of buildings include administrative, maintenance, process, storage, laboratory, and special use and comprise roughly 1.2 million ft^2. The average age of the buildings and structures is 20 years. Figure 4-22 illustrates the current layout of the INTEC physical plant.

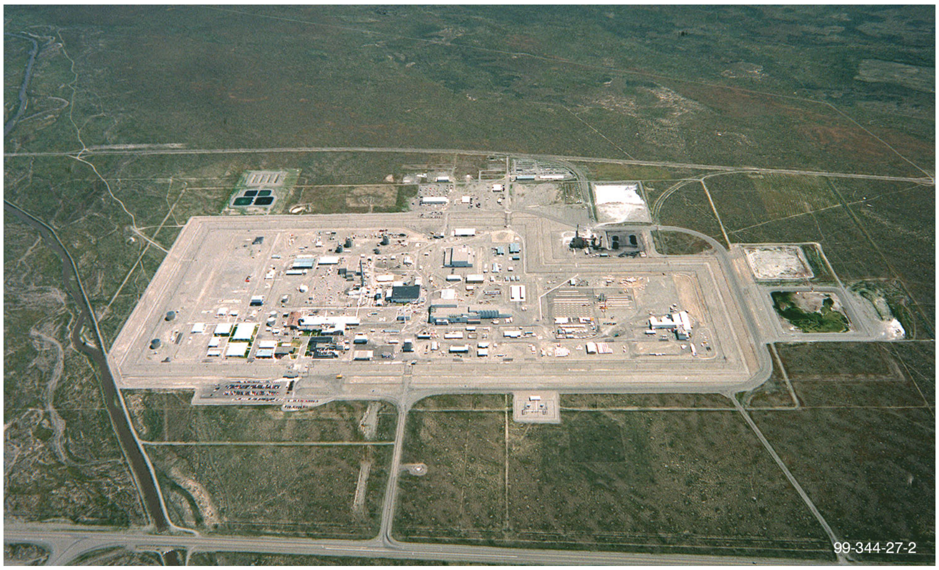

Figure 4-22. Aerial view of the Idaho Nuclear Technology and Engineering Center.

Figures 4-23 and 4-24 depict the INTEC current state and illustrate the currently existing buildings, structures, areas of contaminated surface soil, and an existing HWMA/RCRA postclosure landfill unit (the Waste Calcining Facility [WCF], CPP-633).

The conceptual site model, which has been updated to reflect conditions in 2004, is included as Figure 4-25. The conceptual site model includes contaminated sites that present risks to human health and the environment but does not include engineered waste management facilities such as the ICDF and the calcine storage bins, as those structures are designed and managed so that they do not currently present unacceptable risks to human health or the environment. The OU 3-13 ROD combined release sites into seven groups according to shared characteristics or common contaminant sources, and a single remedy was identified for all release sites within a given group. Remediation is under way in all seven OU 3-13 groups. The seven groups and major elements of the risk-based remediation alternatives or interim actions pursuant to the ROD are described below.

4.4.1.1 Group 1—Tank Farm Soil Interim Actions. Tank farm soil contains about 95% of total radioactivity released to the environment at INTEC. An estimated 146,000 yd^3 of soil at the tank farm have been contaminated by spills or leaks. Tank farm soil was contaminated as a result of historic spills and leaks from piping and valve boxes during transfers of liquid HLW. No evidence has been found to indicate that any of the tanks have leaked. Based on results of drilling and sampling, the extent of contamination has been found to extend to the soil-basalt interface approximately 45 ft below ground. COCs identified at concentrations above risk-based levels include cesium-137, europium-154, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, technetium-99, and uranium-235. Some soil within the tank farm contains high levels of radioactivity, which present risks of potential leaching and transport of contaminants to the perched water or the aquifer. If the soil is disturbed, it could present a risk of direct radiation exposure to workers or the public. The tank farm soil sites are located in the area of the tank farm and next to the process equipment waste evaporator building. Originally, 15 CERCLA sites that require institutional controls were identified within the tank farm soil group: CPP-15, CPP-16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP-30, CPP-31, CPP-32, CPP-33, CPP-58, CPP-79, and CPP-96. This soil was consolidated into one site, CPP-96 in the OU 3-13 ROD. More information is provided in Table 4-6. Limited site investigations have been conducted in the tank farm area because many of the spill areas are located in operational and radioactive areas.

Based on results of drilling and sampling, the extent of contamination is generally localized at the site of the release, but contamination has been found to extend to the soil-basalt interface at approximately 45 ft below ground. Because current information regarding the nature and extent of tank farm contamination is inadequate to support selection of a final remedy, a separate OU 3-14 RI/FS for the tank farm is planned. Since waste stored in the tank farm is mixed waste subject to regulation under RCRA, remedial actions will be integrated with RCRA closure requirements.

Interim actions to minimize contaminant migration from the tank farm are specified in the OU 3-13 ROD (DOE-ID 1999b).

Access to the tank farm has been restricted by way of institutional controls to control exposure to workers and prevent exposure to the public. Surface water controls have been implemented to minimize infiltration through potentially contaminated soil. Measures to minimize this infiltration include: (1) diverting storm water away from contaminated soil with diversion channels designed and built to accommodate and route the 25-year, 24-hour storm event and (2) grading and surface sealing the tank farm soil.

4.4.1.2 Group 2—Soil under Buildings and Structures. Group 2 Soil under Buildings and Structures is comprised of release sites that are located beneath some INTEC buildings and structures. These sites consist of soil contamination that resulted from past hazardous or radioactive liquid spills, leaks, and plant operations. There are nine CERCLA sites in the Soil under Buildings and Structures group that require institutional controls: CPP-02, CPP-41, CPP-60, CPP-68, CPP-80, CPP-85, CPP-86, CPP-87, and CPP-89. Additional information on each of these sites is provided in Table 4-6. Because of inaccessibility of most of these sites, only limited soil characterization data are available. Knowledge of the processes and waste streams at these sites and estimates of the potential leak or spill volumes were used to determine the types and quantities of contaminants that may be present at these sites. COCs identified at concentrations above risk-based levels include americium-241, cesium-137, cobalt-60, iodine-129, neptunium-237, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, technetium-99, tritium, uranium-235, mercury, arsenic, and chromium.

The primary hazards are risks of direct radiation exposure to workers or the public caused by intrusion into contaminated soil and potential soil contaminant leaching and transport to the perched water table or the aquifer.

Until buildings and structures above the sites are closed and DD&D occurs, it is assumed that the building or structure will limit infiltration of water through the contaminated soil and prevent direct exposure to contaminated soil. Institutional controls, such as site-access restrictions and periodic inspections of buildings and structures, will be used to prevent human exposure to contaminated soil. Currently, buildings CPP-601 and CPP-640 are undergoing DD&D engineering design, characterization, and planning, while DD&D of CPP-627 is in progress with completion planned in 2005. A number of

RCRA closures will be required in these facilities. All of these activities are scheduled to be completed by 2012.

4.4.1.3 Group 3—Other Surface Soil. The Group 3 Other Surface Soil sites generally consist of soil contamination that resulted from inadvertent spills and leaks of radioactive waste, decontamination solutions, spent fuel storage water, storage of radionuclide-contaminated equipment, fallout from past emissions, and other plant-generated wastewater. There are 25 CERCLA sites in the Other Surface Soil group that require institutional controls: CPP-01, CPP-03, CPP-04, CPP-05, CPP-08, CPP-09, CPP-10, CPP-11, CPP-13, CPP-14, CPP-19, CPP-34, CPP-35, CPP-36, CPP-37, CPP-44, CPP-48, CPP-55, CPP-67, CPP-91, CPP-92, CPP-93, CPP-97, CPP-98, and CPP-99. Additional information on each of these sites is provided in Table 4-6. Based upon the results of drilling and sampling, contamination generally occurs in the upper few feet of the soil, though some sites have contamination that extends to the surface soil-basalt interface at a depth of about 40 ft. Because of the generally small area and contaminant mass of most release sites, quantities of the following COCs are not believed to pose a significant threat to groundwater: americium-241, cesium-137, cobalt-60, europium-152, europium–154, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, uranium-235, mercury, lead, and chromium. The principal threat to human health is by external exposure to radionuclide COCs identified at concentrations above risk-based levels.

The purpose of the selected risk-based remedies is to prevent external exposure to radionuclides at these sites. The selected remedial action, which includes removing contaminated soil and debris above the 1-in-10,000 risk level, was based on an assumption of potential residential use in 2095 and beyond. Contaminated soil and debris that meet waste acceptance criteria will be disposed of at the ICDF. The excavation will be backfilled with clean soil. To prevent inadvertent occupational exposure to radionuclides remaining at the release sites following remediation, the sites will be surveyed, and contamination left in place will be recorded for institutional control purposes.

4.4.1.4 Group 4—Perched Water. Perched water at INTEC occurs at depths ranging between 100 and 420 ft in the basalt and the sedimentary interbeds beneath the facility. The perched water originated from local recharge by infiltration from sources such as precipitation, the Big Lost River, the former INTEC percolation ponds, the sewage treatment ponds, and lawn irrigation inside the facility fence. The perched water (designated as the CPP-83 CERCLA site) has been contaminated by downward transport of COCs, including tritium, iodine-129, and strontium-90 from overlying surface soil and from two instances when the INTEC injection well casing failed and allowed service wastewater to be released to the perched zones. INTEC perched water does not currently pose a direct human health or environmental threat since it is not used for drinking water; however, perched water does pose a threat as a contaminant transport pathway to the aquifer. Therefore, a response action is necessary to minimize or eliminate the transport of contaminants from this pathway.

The selected remedy for perched water is institutional controls with aquifer recharge control. Institutional controls are in place to prevent use of perched water during INTEC operations and to prevent future drilling into or through the perched zone. The original former INTEC percolation ponds were estimated to contribute approximately 70% of the perched water recharge. The original INTEC percolation ponds were taken out of service, and newly generated, uncontaminated service wastewater is now discharged to new percolation ponds constructed in 2001 nearly 2 miles from INTEC. Construction to tie the treated effluent from the sewage treatment plant into the service wastewater system to further minimize perched water recharge is in progress with completion expected in early 2005.

4.4.1.5 Group 5—Snake River Plain Aquifer. The depth to the water table at INTEC is approximately 450 ft. The aquifer is locally recharged by the Big Lost River and various INTEC sources.

Groundwater in the aquifer has been contaminated by past INTEC operational waste disposal activities. Release site CPP-23 (OU 3-02) consists of the former INTEC injection well, which was the primary source of contamination to the aquifer during its operation from 1952 through 1986. Primary contaminants in the wastewater released to the aquifer were radionuclides, with tritium comprising over 96% of the total contaminant activity and lesser amounts of strontium-90, iodine-129, cesium-137, and technetium-99. The injected wastewater also contained sodium, chloride, and other nonradioactive chemicals.

Subsequent contaminant migration has produced a large contaminant plume in the aquifer that contains relatively low concentrations of tritium, strontium-90, iodine-129, and technetium-99 extending south of INTEC. As of 2004, only strontium-90 and technetium-99 still exceed MCLs in the aquifer at one or more monitor wells. Figure 4-24 shows the current extent of the INTEC strontium-90 plume that exceeds MCLs. In May 2003, technetium-99 above the MCL was detected in a single monitoring well, located in the northern part of INTEC inside the fence line. Monthly sampling of this well showed that concentrations of technetium-99 remained nearly constant during the remainder of 2003 at a level of approximately 2,500 pCi/L as compared with the MCL of 900 pCi/L. The source of the technetium-99 has not yet been conclusively determined, but preliminary results suggest that past releases at the tank farm are the most likely source of the elevated technetium-99 concentrations at this monitoring well. Work is under way to further evaluate technetium-99 in the groundwater.

Groundwater quality profiling has been conducted to define the vertical extent of COCs in the aquifer. During 1992–1994 groundwater samples were collected from various depths using straddle packers in four monitor wells (USGS-44, USGS-45, USGS-46, and USGS-59) located immediately downgradient of INTEC. The results indicate that the concentrations of tritium, strontium-90, and iodine-129 generally decline with depth below the water table. Both tritium and iodine-129 were below their respective MCLs at all depths sampled in all of the wells. Strontium-90 was slightly above the MCL of 8 pCi/L at several depths in three of the four monitoring wells sampled, with the highest concentration reported as 14 ±2 pCi/L at the shallowest depth in monitor well USGS-59. The deepest sample collected from this same well contained 11 ±1 pCi/L of strontium-90.

Vertical groundwater quality profiling was performed again during 2002 in four boreholes drilled in the area between INTEC and CFA. Straddle packer groundwater sampling was performed above, within, and below the interbed, which occurs approximately 150 ft below the water table in this area. The results were similar to the 1992–1994 straddle packer sampling performed in the USGS wells and indicate that concentrations of tritium, technetium-99, and iodine-129 are all below their respective MCLs at all depths sampled in each of the boreholes (DOE-ID 2004f). Strontium-90 concentrations were below the MCL at all depths sampled in three boreholes but slightly exceeded the MCL of 8 pCi/L at the shallowest depth sampled in one of the boreholes, with a maximum concentration of 8.86 ±1.06 pCi/L (DOE-ID 2004f). Additional straddle packer sampling is planned in 2005 to confirm that COC concentrations are declining as expected at all depths within the aquifer and to help refine the vertical profile.

Of the principal COCs, tritium, technetium-99, and iodine-129 all have very high mobility, and it can be assumed that these three COCs are moving downgradient at essentially the same velocity as the groundwater itself. In contrast, the migration of strontium-90 is significantly slower as a result of adsorption to the aquifer matrix. Numerous studies have been done over the years to quantify the rate of groundwater flow downgradient of INTEC. Flow velocities at and near INTEC declined considerably when the injection well was taken out of routine service in 1984. Groundwater flow velocities vary considerably from place to place in the aquifer as a result of the presence of fractures in the basalt that permit more rapid localized flow. The most recent data and modeling results indicate that the average groundwater flow velocity downgradient of INTEC is approximately 6–7 ft/day to the south-southwest (DOE-ID 2004f).

An interim action for the Snake River Plain Aquifer was specified in the OU 3-13 ROD (DOE-ID 1999b). While the OU 3-13 ROD identified remedial actions for contaminated Snake River Plain Aquifer groundwater outside of the current INTEC security fence, the final remedy for the contaminated portion of the Snake River Plain Aquifer inside the INTEC fence line was deferred to OU 3-14. The Snake River Plain Aquifer interim action remedy includes:

- Implement institutional controls, including land-use restrictions, to prevent the use of Snake River Plain Aquifer groundwater over the area of the aquifer that exceeds the MCLs for tritium, iodine-129, and strontium-90 until drinking water standards are met, which are projected to be achieved by 2095. These institutional controls include site access restrictions and drilling restrictions.

- Construct new Snake River Plain Aquifer monitoring wells outside of the current INTEC security fence.

- If observed COC concentrations exceed their action levels at a sustained pumping rate of at least 0.5 gpm for 24 hours, implement pump-and-treatment remedial action. Extract contaminated Snake River Plain Aquifer groundwater from the zone of highest contamination and treat to reduce the contaminant concentrations to meet MCLs by 2095. The action level is the modeled maximum concentration predicted in the year 2000 so that the MCL will not be exceeded in 2095 (the date that was assumed to represent the projected end of the institutional control period in the OU 3-13 ROD).

- It is anticipated that standard pump and chemical or physical treatment (which may include evaporation in the ICDF complex surface impoundment) will be able to meet the aquifer restoration goal. Treatability studies, which include a technical evaluation of treating the iodine-129 and other COCs, will be conducted as part of this remedy. These studies may include evaluation of the ability to treat and selectively withdraw contaminants from the aquifer.

- If the treatability studies indicate the presence of sufficient quantities of iodine-129 and other COCs, and contaminated groundwater can be selectively extracted and cost-effectively treated to meet the drinking water MCLs outside the current INTEC security fence by 2095, then implement active remediation.

- Either return treated water to the aquifer through land recharge (1) in accordance with the Idaho wastewater land application applicable or relevant and appropriate requirements if a recharge impoundment is used or (2) in accordance with National Pollutant Discharge Elimination System and State Pollutant Discharge Elimination System applicable or relevant and appropriate requirements if the treated effluent is discharged to the Big Lost River, or evaporate it in the ICDF complex evaporation pond or equivalent.

Institutional controls are currently in place, and groundwater monitoring is being performed to ensure that the remedial action objectives for the aquifer are met by 2095, as required. There are 115 wells in the INTEC monitoring network. With the exception of the recent detection of technetium-99, concentrations are declining for all of the Snake River Plain Aquifer COCs identified in the OU 3-13 ROD (DOE-ID 1999b). Five-year reviews will be conducted as required under CERCLA to assess the effectiveness of the selected remedial alternative. The first 5-year remedy effectiveness review for OU 3-13 is due in October 2005.

4.4.1.6 Group 6—Buried Gas Cylinders. Sites CPP-84 and CPP-94 are located outside the current INTEC security fence. Although both sites still maintain institutional controls, site CPP-94 has been remediated, and confirmatory sampling has verified that the remediation goals have been met. The site still requires revegetation, which is scheduled to be completed in 2004. Remediation of site CPP-84 is in progress. The site consists of a buried trench where approximately 160 compressed gas cylinders have been discovered. Gases in the cylinders may include acetylene, compressed air, argon, carbon dioxide, chlorine, chlorodifluoro methane (R-22 refrigerant), helium, hydrogen fluoride, nitrogen, or oxygen. These gasses do not pose a human health risk but are considered a safety hazard because ruptures of the cylinders could lead to personal injury, fire, or explosion. The buried cylinders pose a safety hazard to inadvertent intruders (i.e., back hoe operators or drillers). However, institutional controls are in place to protect workers and the public.

The selected remedy pursuant to the ROD includes removing gas cylinders using a contractor specializing in gas cylinder removal; treating cylinder contents, if necessary; and recycling or disposing of empty gas cylinder containers. The agencies may elect to pursue a contingent remedy of capping in place if safety concerns with excavation and removal prevent implementation of the selected remedy.

Removal of the gas cylinders at CPP-84 is scheduled to be completed by the end of calendar year 2004. It is expected that neither CPP-84 nor CPP-94 will require institutional controls after remediation. This will be evaluated in the 5-year review scheduled for 2005.

4.4.1.7 Group 7—SFE-20 Hot Waste Tank System. The SFE-20 Hot Waste Tank System consists of a concrete vault containing an abandoned liquid mixed-waste storage tank. This site is designated as CERCLA site CPP-69. The tank contains about 35 gal of sludge. Although there were spills within the tank vault and pump pit, no data exist to determine if contamination exists under SFE-20. The major threat posed by the SFE-20 Hot Waste Tank System is a potential release to underlying soil, subsequent leaching and transport of contaminants to the aquifer, and subsequent exposure of future groundwater users to radionuclides through ingestion. Preliminary investigation in 1984 indicated the tank sludge contained elevated levels of cesium-137, cesium-134, cobalt-60, strontium-90, and isotopes of europium, plutonium, and uranium. The selected, risk-based remedial alternative for the SFE-20 Hot Waste Tank System is removal, treatment, and disposal. This alternative includes:

- Removal and onsite treatment of the tank contents and off-Site disposal of the tank and its contents
- Land disposal of the vault and other debris at the ICDF
- Any contaminated soil that may exist beneath the structure exceeding risk-based levels will be excavated and disposed of in the ICDF.

Since the DEQ has determined that the SFE-20 system has stored mixed waste, RCRA closure of the SFE-20 tank system also will be required.

4.4.1.8 Other Sites Requiring Institutional Controls. There are nine additional sites requiring institutional controls at INTEC. These sites are CPP-06, CPP-17, CPP-22, CPP-88, CPP-90, and CPP-95. Additional information on these areas is provided in Table 4-6.

4.4.1.9 INEEL CERCLA Disposal Facility. The consolidation and management of contaminated soil from the INL at a single location to prevent exposure of human and ecological receptors was one of the remedial decisions documented in the OU 3-13 ROD (DOE-ID 1999b). The ICDF, located at the southwest corner of the INTEC facility outside the facility fence, was constructed in 2003 (see Figure 4-15). The ICDF is an engineered facility that meets the substantive requirements of RCRA

Subtitle C and the Toxic Substances Control Act polychlorinated biphenyl (PCB) landfill design and construction requirements. Major components of the ICDF complex include the landfill, an evaporation pond comprised of two cells, and the Staging, Sizing, Storage, and Treatment Facility. The landfill is comprised of two disposal cells that cover approximately 80 acres and have a disposal capacity of about 510,000 yd^3. Waste to be disposed of in the ICDF will consist of contaminated soil, debris, and CERCLA-investigation-derived waste.

The landfill is designed to be protective of the Snake River Plain Aquifer, such that groundwater contamination does not exceed applicable State of Idaho groundwater quality standards. The liner system is comprised of a primary liner and secondary liner, along with a leachate collection and removal system. This will prevent contaminants from migrating from the landfill and evaporation ponds. More complete details on the landfill design are provided in the *INEEL CERCLA Disposal Facility Complex Remedial Action Work Plan* (DOE-ID 2003c).

The ICDF landfill began accepting waste for disposal in the fall of 2003 and will continue to accept solid waste for a 15-year operations period, with an anticipated closure date of 2018. The ICDF landfill waste acceptance criteria document provides limits for the quantities of radioactive materials that may be accepted for disposal at the ICDF landfill. These limits are based on remedial action objectives outlined in the OU 3-13 ROD (DOE-ID 1999b), which include preventing the release of leachate to underlying groundwater that would result in exceeding a cumulative carcinogenic risk of 1 in 10,000 or applicable State of Idaho groundwater quality standards.

4.4.1.10 The Tank Farm Facility. The tank farm is a collection of 15 belowground stainless steel tanks enclosed in belowground concrete vaults. The tank farm includes 11 belowground 300,000-gal and 318,000-gal tanks (numbered WM-180 through WM-190 and hereinafter referred to as 300,000-gal tanks) and four belowground 30,000-gal tanks (numbered WM-103 through WM-106). Built between 1951 and 1964, the tank farm facility was historically used to store numerous waste types such as first-, second-, and third-cycle waste from spent nuclear fuel reprocessing operations; decontamination waste; lab waste; contaminated water; and filter leach solutions. Waste segregation was historically important for operational considerations (decay heat and calcination chemistry). Calcination of the liquid mixed HLW in the tank farm was completed in 1998. The tanks that were emptied through this process were reused for storage of sodium-bearing and newly generated liquid waste. At present, the tank farm contains approximately 1 million gal of sodium-bearing waste (a mixed waste), which are stored in three tanks: WM-187, WM-188, and WM-189. Technologies for disposition of the sodium-bearing waste are being evaluated.

The tank farm tanks and ancillary equipment are subject to RCRA closure requirements. Of the 15 tank farm tanks, 10 have been emptied, cleaned, and sampled. These include WM-181–186 and WM-103–106. Tank WM-180 is in the final stages of being emptied. Tank WM-180 will be emptied, cleaned, and sampled by the end January 2005. Tank WM-190 is a spare tank and never has been used to store HLW; however, an inadvertent transfer of a small quantity of waste into the tank took place approximately 20 years ago. The tank was emptied, but as a result of this event, the tank will require sampling and characterization prior to closure.

The tanks contain instrumentation to monitor temperature, pressure, level, and density of the liquid waste. A vessel off-gas system prevents accumulation of hydrogen in the tanks, and relief systems prevent overpressurization of excessive vacuum conditions.

Each 300,000-gal tank is contained in a concrete vault located approximately 45 ft below ground. The 6-in.-thick-concrete vault roofs are covered with 10 ft of soil to provide radiation shielding. Each vault contains at least one sump and steam jet pump to remove any liquid waste or surface water that may leak into the vault. The sumps have liquid-level detectors and high-level alarms.

Although no known releases have occurred from the tanks themselves to environmental media, two significant releases from tank farm piping to surrounding soil have occurred. The contaminated soil in the tank farm area is subject to interim actions and eventual remediation under WAG 3 OU 3-14, as described earlier.

4.4.1.11 Calcine Bin Sets. Since 1963, liquid waste stored at the tank farm has been converted to a dry, stable granular form called calcine. Two INL facilities have been used to calcine HLW. The WCF operated from 1963 to 1981. The New Waste Calcining Facility began operations in 1982.

Calcination achieves an eight-to-one reduction from liquid to solid. The final waste form is a dense powder, similar in consistency to powdered detergent. The calcine is mixed HLW subject to regulation under RCRA. As of February 1998, all of the liquid HLW derived from first-cycle uranium extraction was converted to calcine. Calcining of the sodium-bearing waste and newly generated liquid waste remaining in the tanks continued through May of 2000. The resulting calcine is stored in Bin Set 6. The calciner was placed in standby condition in May 2000.

Calcine is stored in the Calcined Solids Storage Facilities, which are referred to as bin sets. A bin set is a concrete vault containing three to seven stainless steel storage bins. There are seven bin sets at INTEC: six operational and one spare. There are currently about 4,400 m^3 of mixed HLW calcine in the bin sets. A RCRA permit application will be submitted to DEQ during Fiscal Year 2004 for continued safe storage of calcine in the bin sets. The calcine poses less environmental risk than storing the liquid radioactive waste in belowgrade tanks.

4.4.1.12 Other Idaho Nuclear Technology and Engineering Center Closure Requirements. For the past several years, efforts have been under way to consolidate spent nuclear fuel from various INL locations to INTEC. Spent nuclear fuel is currently stored in dry storage facilities, as well as in a modern and compliant fuel storage basin. The *Settlement Agreement* (DOE 1995) requires that all spent nuclear fuel be removed from Idaho by January 1, 2035.

The WCF (CPP-633) treated acidic aqueous waste generated from the reprocessing of spent nuclear fuel. In 1998, the WCF was closed with waste in place (landfill closure) and covered with a concrete cap under an approved HWMA closure plan. The DEQ has issued a RCRA Part B postclosure permit. The permit establishes procedural requirements for groundwater characterization and monitoring, maintenance, and inspection procedures for the WCF to ensure continued protection of human health and the environment.

There are many RCRA hazardous waste units at INTEC. These will all require RCRA closure under approved closure plans.

In June of 2000, DOE and Idaho Department of Health and Welfare, Division of Environmental Quality, entered into a VCO with respect to potential RCRA issues at the INL. An action plan established enforceable milestones within which DOE must achieve compliance with regard to specific issues or “covered matters.” INTEC VCO items that remain open for completion are grouped under SITE-TANK-005 and NEW-CPP-016. SITE-TANK-005 includes approximately 146 tanks requiring hazardous waste determinations or verification of empty. NEW-CPP-016 encompasses eight tank system components that were part of the water treatment system for the spent nuclear fuel storage basin in CPP-603. Tank systems characterized as containing RCRA hazardous waste will require RCRA closure. The closure approach could range from clean closure to performance-based closure to closure at landfill standards. At this point, VCO-driven HWMA/RCRA closures conducted at INTEC have not included closure to landfill standards; hence, they have not materially impacted the visual or physical end state.

The INTEC ash pit was used for the disposal of waste associated with the combustion of fossil fuels. This waste included fly ash from the INTEC coal-fire boilers, along with small quantities of unused limestone, coal, and boiler soot from other INL oil-fired boilers. The ash pit will be required to comply with the applicable cover, seeding, grading, and closure requirements specified in "Solid Waste Management Rules" (IDAPA 58.01.06, Subsection 0001.04[d][i-iii]).

There are currently 62 sites at INTEC under institutional control. Additional information on contaminant concentrations and risk at these sites is provided in Table 4-6.

4.4.2 End State

Figures 4-26 and 4-27 illustrate the anticipated INTEC end state at 2035.

The INTEC 2035 end state, as shown in the conceptual site model in Figure 4-28, will require completion of FFA/CO specified actions, VCO closures, RCRA closures, and INTEC-specific strategic initiatives as spelled out in the *Performance Management Plan* (DOE-ID 2002b).

The *Settlement Agreement* (DOE 1995) contains several requirements that apply to closure activities at INTEC. These requirements address disposition of spent nuclear fuel and management and disposition of HLW in the tank farm and in the calcine bin sets. The specific requirements are:

- All spent nuclear fuel must be removed from the State of Idaho and shipped to an off-Site repository by January 1, 2035

- All sodium-bearing liquid HLW must be converted to calcine by December 31, 2012

- Treatment of all calcined HLW must be completed so that it is ready to be moved out of Idaho for disposal by a target date of 2035.

The *Settlement Agreement* (DOE 1995) allows DOE to propose changes to these requirements, provided they are based on adequate environmental analyses under NEPA, and the State of Idaho has stated that they will agree to such changes if they are reasonable (DOE 2002b). For example, the *Settlement Agreement* requires use of the calciner as the treatment process for liquid mixed sodium-bearing waste in the tank farm. It is possible that a treatment technology other than calcination could be selected for treatment of the sodium-bearing waste. In this case, modification of the *Settlement Agreement* would be required. Because of technology developments and changes needed in existing treatment facilities to properly manage sodium-bearing waste, Idaho agreed with DOE that an EIS could facilitate negotiations required by the *Settlement Agreement*. The State of Idaho, therefore, participated in the EIS as a cooperating agency.

Closure alternatives for the calcine bin sets, tank farm, and other HLW facilities at INTEC were analyzed in the HLW EIS (DOE 2002b). No ROD has yet been issued for the HLW EIS. The document evaluates and presents the potential environmental consequences of various alternatives for managing HLW calcine, sodium-bearing waste, and newly generated liquid waste at INTEC. The EIS also analyzes alternatives for final disposition of HLW management facilities after their missions are completed. The EIS can be viewed at the following web site: http://www.id.doe.gov/EIS/HLW_EIS.htm.

Although a final ROD for the HLW EIS has not been issued, the document examines facility disposition alternatives in detail and contains an extensive analysis of environmental impacts and risk associated with the various closure options. This risk assessment is further discussed in Section 4.4.3.1.3.

Both DOE and the State of Idaho have individually designated performance-based closure methods as their preferred alternative for disposition of HLW facilities at INTEC. Closure to landfill standards is required if mixed hazardous waste is left in place. The HLW EIS also states that all newly constructed facilities necessary to implement waste processing alternatives examined by this EIS will be designed and constructed in a manner that facilitates clean closure. The OU 3-13 ROD (DOE-ID 1999b) supports this overall closure approach through a deferred action remedy for Soil under Buildings and Structures. If the completed DD&D configuration is assessed as inadequate for long-term protection of human health and the environment (e.g., clean closure cannot be achieved), then contaminated soil will be capped in conformance with applicable and relevant hazardous waste landfill closure requirements (IDAPA 58.01.05.008 [40 CFR 264.310]) with an engineered barrier or removed and disposed of at the ICDF.

4.4.2.1 Tank Farm Closure. HLW and sodium-bearing waste are classified as mixed waste and are dually regulated by DEQ for hazardous constituents and by DOE for radioactive constituents. Consequently, the tank farm closure must comply with hazardous waste as well as radioactive waste closure requirements. The planned end state for the tank farm is a deactivated HLW facility and a clean closed HWMA/RCRA unit. The closure described below typifies the current and anticipated closure strategy for mixed waste tank systems closed under the HWMA/RCRA and "Radioactive Waste Management" (DOE O 435.1). Compliance with the "Closure Performance Standard" (40 CFR 265.111) and "Closure and Post-Closure Care" (40 CFR 265.197) requirements for closure of tank systems will be demonstrated by sampling the final rinsate solutions from decontamination efforts and comparing the resulting analytical data with risk-analysis-derived action levels. Risk-based action levels are developed by defining the acceptable excess cancer risk and HQ thresholds and calculating corresponding action levels based on these risk and hazard thresholds. The excess cancer risk and HQs are calculated for appropriate facility-specific exposure pathways and COCs based on the developed action levels.

Under the terms of the 1992 consent order (and subsequent modifications) between the DEQ and the DOE, DOE must permanently cease use of all tanks in the tank farm or bring the tanks into compliance with RCRA requirements for secondary containment by December 31, 2012. Ceasing use of the tanks, as defined in the consent order, means that DOE must empty the tanks down to their heels (i.e., the liquid level remaining in each tank must be lowered to the greatest extent possible by the use of existing transfer equipment). DOE plans to close the tanks because high-radiation fields and possible high radiation dose to workers would make compliance with secondary containment requirements difficult, and a need for storage of this magnitude is not anticipated after 2012. HWMA/RCRA closure plans for the tank farm describe a strategy for clean closure to site-specific action levels; however, in the event that these action levels cannot be attained, a contingent landfill closure plan has been developed. The final closure plan will address closure requirements and any required postclosure care of the tank farm.

The tanks will be closed in phases. Of the 15 tanks, 10 have been emptied, cleaned, and sampled in preparation for RCRA closure. Tank WM-180 will be emptied, cleaned, and sampled by the end of January 2005. Tank WM-190 was never used to store HLW and is currently empty, but because of an inadvertent transfer of a small quantity of waste to the tank about 20 years ago, it will require sampling and characterization prior to closure. Tanks WM-187, WM-188, and WM-189 will be cleaned and closed in subsequent phases as the current inventory of sodium-bearing waste is processed for permanent disposal during planned future treatment campaigns. However, because of the litigation related to "Radioactive Waste Management" (DOE O 435.1), final closure of the tanks has been placed on hold until the litigation is sufficiently resolved.

Extensive risk assessments to support closure decisions for the tank farm are published in the *Composite Analysis for Tank Farm Closure* (DOE-ID 2003d) and in the HLW EIS (DOE 2002b).

Two significant releases from tank farm ancillary equipment to surrounding soil have occurred: one in 1955 and another in 1972. These releases are subject to investigation and remediation as necessary under the FFA/CO. Migration of tank farm soil contaminants also poses a potential future risk to the aquifer. Evaluation of these risks and potential remedial actions will be the focus of a RI/FS under OU 3-14. Based upon groundwater monitoring and contaminant transport modeling, the contaminant plume is not expected to migrate beyond the INL boundary at concentrations exceeding MCLs, and strontium-90 levels in the aquifer south of INTEC are expected to fall below the Idaho groundwater quality standard by 2095. Therefore, no contaminant plumes exceeding MCLs are shown on the end state map (see Figure 4-26). Work is under way to evaluate technetium-99 in the aquifer, and appropriate actions will be identified.

4.4.2.2 INEEL CERCLA Disposal Facility Closure. The planned closure approach for the ICDF is to clean and close all areas of the complex, except the landfill, which will be closed with an engineered cover in accordance with the substantive and applicable requirements of HWMA/RCRA. The decontamination building will be closed by recycling or reusing equipment and materials that are not contaminated or can be decontaminated. Any equipment or materials that cannot be decontaminated will be disposed of in the ICDF landfill. The building will be demolished, and debris will be placed in the ICDF landfill. The decontamination building discharge piping to the evaporation pond will be removed and disposed of in the landfill. Following demolition of the building, any contaminated subsoil will be placed in the landfill.

The contaminated equipment pad will be demolished, and the contaminated debris and subsoil will be placed in the ICDF landfill. The Staging, Sizing, and Treatment Facility storage area may be retained as a storage facility should there be a need for CERCLA storage after the lifetime of the landfill. However, if the Staging, Sizing, and Treatment Facility is not needed, it will be cleaned and closed. As necessary, contaminated asphalt concrete area subsoil and fencing will be removed and placed in the ICDF landfill.

The remaining facilities, including staging areas, administrative building, truck scales, and miscellaneous utilities, will be closed following receipt of final waste from INL CERCLA sites. Contaminated materials, equipment, or subsoil will be placed in the ICDF landfill. Verification sampling will be performed to document the removal of contamination.

Closure of the evaporation pond cells will be conducted in accordance with the substantive requirements of “Closure and Post-Closure” (40 CFR 264 Subpart G), “Closure and Post-Closure Care” (40 CFR 264.228), and “Corrective Action Management Units (CAMU)” (40 CFR 264.552[e][4]). The following steps will be taken in closing the evaporation pond cells:

- Remove and dispose of all liquids and solids within the evaporation pond
- Decontaminate or remove and dispose of contaminated containment system components
- Remove and dispose of contaminated subsoil
- Decontaminate or remove and dispose of pumps, piping, and equipment within the crest pad buildings and between the landfill and the evaporation pond
- Demolish crest pad buildings and dispose of resulting debris

- Grade evaporation pond embankments to provide a smooth area with positive drainage, and blend the area with the surrounding topography.

Contaminated materials including liquids, solids, containment system components, subsoil, equipment, or building debris will be disposed of in accordance with CERCLA. Contaminated materials will be mixed waste that, depending on the disposal facilities available at the time, will be disposed of off-Site or on-Site. Building debris and equipment will be recycled, reused, or disposed of at an off-Site or on-Site industrial landfill, provided the material can meet appropriate disposal requirements. Any sediment removed from the evaporation pond will meet the substantive requirements of "Universal Treatment Standards" (40 CFR 268.48) before disposal.

A contingent closure option may be implemented by DOE Idaho depending on the operating history of the evaporation pond, the extent of contaminated containment components, and the available options for disposal of contaminated materials. The contingent closure option will consist of constructing a cap and cover system, similar to that designed for the landfill, for the evaporation pond. The details of this contingent closure option would be defined as part of the additional closure information submitted to the agencies before closure.

The final cover is designed to protect the disposed waste for a period of 1,000 years. The ICDF landfill will be closed through the placement of a final cover system designed to minimize long-term infiltration and protect against inadvertent intrusion for a minimum of 1000 years. The final cover system design and postclosure operations will meet the substantive standards of "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" (IDAPA 58.01.05.008). Before the final cover system is placed, the landfill already will be covered by a layer of clean fill over the waste.

The cover system has been designed to minimize infiltration and maximize run-off by maintaining a sloped surface, storing water for later release to the atmosphere, providing lateral drainage, and providing a low-permeability composite-liner barrier system. The cover can be divided by function into three primary layers:

- Upper layer: A 5–6.5-ft-thick layer of silty loam-type soil will provide water storage during wet periods for later release to the atmosphere during dry periods. This will provide for long-term minimization of liquid migration through the closed landfill, while functioning with minimal maintenance.

- Middle layer: The middle section will contain a biointrusion layer that provides protection from burrowing animals as well as a capillary break. This will consist of a layer of 2–5 in. of gravel. Studies have shown that a thin layer of gravel is effective in preventing animals and ants from penetrating underlying waste materials.

- Lower layer: The lower section will include a composite-liner system that has a permeability less than or equal to the permeability of the landfill bottom liner and provides for lateral drainage through a high-permeability liner. The barrier layers consist of a single high-density polyethylene geomembrane/soil bentonite layer composite system. This system is designed to intercept any water penetrating the upper cover sections and divert it laterally through the overlying sand and gravel layers.

Each of the layers will be separated by filter layers composed of graded sands and gravels designed to prevent fine materials from the overlying layer from migrating downward.

The ICDF landfill closure requirement will include access restrictions with a buffer zone that will be maintained around the landfill for as long as the landfill contents remain a threat to human health and the environment. The institutional controls are designed to prevent disturbance of closed areas and to maintain a cumulative carcinogenic risk of less than 1 in 10,000 and a total HI of 1.

DOE is required to monitor the ICDF complex after its operational life is completed. The institutional controls for this facility will include signage, security, and monitoring. The long-term management of the ICDF complex and associated monitoring and maintenance will be transferred to the INL Long-Term Stewardship Program. DOE Idaho will place easily visible permanent markers at all the corner boundaries for each cell of the landfill and identify the potential hazards. In addition, DOE will maintain all institutional controls until that responsibility is passed, along with management of the property, to another federal agency such as the BLM.

DOE Idaho will further ensure that the final cover is designed to serve as an intrusion barrier for 1,000 years. If ownership of any portion of the land is ever proposed for transfer outside the federal government, the DOE will fulfill the requirement of "Federal Facilities" (42 USC 9620, CERCLA Section 120[h]) to provide the transferee with complete notification and warranty of completed remedial actions. At such time, the federal zoning restrictions and deed restrictions on the ICDF landfill and its adjacent buffer zone will be used to preclude industrial, institutional, or residential development until unacceptable risk no longer exists. These documents will include disposal records and marker locations. These conditions will be verified as part of the 5-year review.

Additional information regarding closure plans for the ICDF complex is provided in the *INEEL CERCLA Disposal Facility Complex Remedial Action Work Plan* (DOE-ID 2003c).

4.4.2.3 Calcine Disposition. Current plans and agreements call for the calcine to be characterized, retrieved, treated if necessary, and packaged in canisters for disposal in the Yucca Mountain repository. The Yucca Mountain repository is expected to begin accepting waste in 2010.

Presently, the calcine does not meet expected waste acceptance criteria for the proposed repository at Yucca Mountain. INTEC's mixed HLW calcine and sodium-bearing waste contain listed hazardous constituents that are regulated under RCRA. The treated waste would still continue to be regulated as mixed waste under RCRA, unless it can be delisted or otherwise excluded from the regulatory requirements of RCRA. The Yucca Mountain repository currently is not permitted to receive RCRA regulated waste.

Work is under way to address uncertainties associated with retrieval and packaging of calcine. These activities will include sampling, engineering, and radioactively cold and hot retrieval demonstrations. A complete retrieval and characterization demonstration will be performed, and a calcine treatment ROD will be prepared in accordance with the *Settlement Agreement* (DOE 1995). A RCRA Part B Permit application for calcine treatment (if required), retrieval, and packaging will be required to begin design of the retrieval facility. Once the calcine is packaged, shipment to an acceptable repository is anticipated to take approximately 7 years.

RCRA closure of the calcine storage bins will take place after the calcine has been retrieved and packaged for shipment. The *Settlement Agreement* requires that the calcine be ready for shipment by 2035.

The HLW EIS (DOE 2002b) evaluated several closure alternatives related to calcine disposition. These included the No Action alternative (where calcine would be left in the bin sets and no further action would be taken), retrieval and packaging without treatment, and retrieval with various treatment options.

4.4.2.4 Other Cleanup and Closure Activities. All required VCO actions will be completed by 2012. The *Settlement Agreement* requires that all spent nuclear fuel be removed from the INL Site by January 1, 2035, for shipment to an off-Site repository.

Some facilities within INTEC are being considered for long-term use to support the future NE mission. By 2035, all facilities without future missions will have undergone inactivation and DD&D. Some foundations may remain where grouting and capping were not necessary. Some facilities associated with Soil under Buildings and Structures, such as CPP-601 and CPP-640 fuel reprocessing complex; CPP-659 calcination building; and CPP-604, CPP-605, and CPP-649 rare gas plant and process equipment waste evaporator, may be grouted and capped. The tank farm will be RCRA closed, grouted, and capped. Necessary fences and signs will remain as required by OU 3-13 ROD (DOE-ID 1999b), the eventual OU 3-14 ROD, and institutional control plans. Roads and other minimal infrastructure will remain and be maintained as necessary to access and manage the capped buildings and structures.

Groundwater remediation and monitoring are expected to continue beyond 2035. The end state for groundwater cleanup is 2095, at which time no contaminants above MCLs are expected to remain at established points of compliance.

4.4.3 Risk Assessment Summary

Risk assessment information for INTEC sites is published in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)* (Rodriguez et al. 1997). The baseline risk assessment was conducted to document the magnitude and primary causes of risk at a site, determine whether additional response actions were necessary at any release site, and help support selection of remedial alternatives. Therefore, the baseline risk assessment results described below represent conditions at a site caused by hazardous substance releases in the absence of any actions to control or mitigate those releases.

INTEC land-use assumptions used to develop the risk-based remedial action objectives were based on industrial use until 2095, with loss of federal control and potential residential use thereafter. The human health remedial action objectives developed for seven specific groupings of soil and groundwater release sites at INTEC are specified in the OU 3-13 ROD (DOE-ID 1999b).

The risk management decisions produced by the OU 3-13 remedial investigation and baseline risk assessment identified 42 sites that required further evaluation in the feasibility study.

Risks to human health are controlled through the use of institutional controls (i.e., fencing, signs, and other access restrictions). Risks to the current worker and the future worker (beyond 2095), without reliance on institutional controls, are estimated in the baseline risk assessment in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)*. Risks to current and future workers are controlled by the health and safety and radiological control practices currently used at the site.

4.4.3.1 Human Health Risk Assessment. The baseline risk assessment assumed that INTEC will remain a restricted-access INL industrial facility under federal government management and control until the year 2095. INTEC was projected to remain in operation until about 2045. Because current industrial uses are expected to continue in the future, the future land-use scenario included occupational workers. It also was assumed that residential development may occur after 2095. Thus, exposures to hypothetical future on-Site residents may occur and were evaluated in the risk assessment. The residential receptor was assumed to be an adult for all potentially complete pathways; additionally, a child receptor was included in the soil ingestion pathway assessment. For this pathway, the child and adult parameters were averaged on a time-weighted basis. Child exposures were evaluated specifically for the soil ingestion exposure route because children have the potential for much greater exposure by way of this route. The timing for the future land-use exposure scenarios was assumed to be 100 years in the future for both the occupational and residential receptors.

The human health risk assessment consisted of two steps: (1) a site and contaminant screening that identified COCs at the release sites and (2) an exposure route analysis for each COC. The risk assessment included an evaluation of human health risk associated with (1) exposure to contaminants through soil ingestion, (2) external radiation exposure, (3) ingestion of homegrown produce, (4) inhalation exposure, and (5) ingestion of groundwater. The predicted soil and groundwater pathway risks were used to assess the threat posed by the release sites to human receptors. Cumulative site risks were estimated by adding the predicted soil and groundwater risk values. This risk assessment approach was used to provide conservative risk estimates, which probably overestimate the actual site risks. Risk estimates were developed for current and future occupational receptors and a hypothetical future residential receptor.

Results of the CERCLA baseline risk assessment under the various land-use assumptions indicate that there are a number of groups and sites that present a high potential to adversely affect human health and the environment. Specifically, under future residential exposure assumptions, the increased cancer incidence at several of these sites was found to exceed the target risk range (one in 10,000 to one in one million excess cancer risk) or the noncarcinogenic HI of 1 established by the National Contingency Plan.

Assuming there are no actions to control or mitigate contamination at the sites, results of groundwater modeling predicted that chromium, mercury, tritium, iodine-129, neptunium-237, and strontium-90 would exceed their MCLs before the year 2095. After 2095, mercury, strontium-90, iodine-129, and total plutonium concentrations were predicted to exceed the MCLs. Total plutonium was predicted to exceed the MCL beginning in the year 2850. From an interpretation of the model results, most of the iodine-129 and mercury source are from the injection well. For strontium-90 and total plutonium, the injection well contributes to most of the pre-2095 source, but thereafter, most of the strontium-90 and plutonium come from the vadose zone. The 100-year residential scenario was the only scenario for which groundwater was considered a pathway. The risks calculated for the Snake River Plain Aquifer are on-Site risks. There are no projected off-INL impacts to downgradient Snake River Plain Aquifer users.

4.4.3.1.1 Ecological Risk Assessment—The ecological receptor exposure assessment estimated the magnitude, frequency, duration, and exposure routes between the environment and the ecological receptors that contact the contaminants. This exposure was then evaluated to determine potential adverse effects to ecological receptors.

Release sites whose maximum contaminant concentrations were less than the INL background or whose maximum contaminant concentrations were less than ecologically based screening levels were eliminated. Release sites with exposure point concentrations greater than 10 times the INL background constituent concentrations were considered to pose a potential risk to ecological receptors and were retained for analysis in the feasibility study.

Of the 95 release sites assessed, 27 of the sites were shown to pose a potential risk to ecological receptors as well as to human health. Four additional sites, CPP-14, CPP-44, CPP-55, and CPP–66, solely pose an ecological risk from contaminants that have exposure point concentrations exceeding 10 times the INL background concentrations. The remaining 64 sites were determined not to pose a risk to ecological receptors. For sites that pose a potential threat to both human and ecological receptors, it is assumed that alternatives developed to address human health risks also will adequately address ecological concerns. Alternatives for sites CPP-14, CPP-44, and CPP–55, which solely pose an ecological risk, were developed under the Other Surface Soil sites group. Final closure of site CPP-66 will be conducted under the Solid Waste Management Landfill Closure Program and will be designed to address the ecological risks identified for this site.

For INTEC release sites that pose a potential threat to both human health and ecological receptors, it is assumed that remedies selected to protect human health also will address ecological risks. The OU 10-04 ROD (DOE-ID 2002a) determined that no additional actions were needed at WAG 3 sites to protect ecological receptors.

4.4.3.1.2 Radioactive Waste Management Risk Assessment—The "Radioactive Waste Management" (DOE O 435.1) and "Radioactive Waste Management Manual" (DOE M 435.1-1) require that performance assessments and composite analyses be conducted before disposal authorizations are issued for LLW facilities. Performance assessments are conducted to evaluate the expected performance of the proposed LLW disposal facility or HLW facility closure. The composite analysis is used to estimate the projected cumulative impacts to hypothetical future members of the public from the LLW disposal facilities, proposed HLW facility closures, and all other sources of radioactive contamination at the INL that could interact with the facility to affect the radiological dose.

Risk to human receptors from the radioactive materials that will be disposed of in the ICDF landfill was evaluated in the *Composite Analysis for the INEEL CERCLA Disposal Facility Landfill* (DOE-ID 2003e). "Radioactive Waste Management" (DOE O 435.1) requires that a risk assessment be conducted to confirm that a proposed radioactive waste disposal facility will not result in radiation doses to the public that exceed the limits in "Radiation Protection of the Public and the Environment" (DOE O 5400.5). A primary dose limit of 100 mrem/year, total effective dose equivalent, is the basic performance measure. However, to ensure the potential dose from the aggregate of sources analyzed is not likely to exceed a significant fraction of the primary dose limit, and administratively limited dose constraint of 30 mrem/year is established. If modeling indicates that the dose constraint could be exceeded, then an options analysis to identify mitigating measures is required. The period for which the dose limit must not exceed is 1,000 years after closure of the facility. This period is referred to as the "compliance period."

The composite analysis assesses and quantifies the total potential dose to a hypothetical future member of the public from the ICDF landfill and all other radioactive material sources that will potentially contribute to the dose from the ICDF landfill when operations at the INL have ceased. The primary pathway for migration of radionuclides from the ICDF landfill is the underlying Snake River Plain Aquifer. The predicted peak groundwater all-pathways dose to a receptor located 100 m (328 ft) south of the ICDF landfill during the 100-year institutional control period was estimated to be 0.06 mrem/year, occurring in the year 2018. The predicted peak groundwater all-pathways dose during the 1,000-year period from 2018 to 3018 was modeled to be 0.05 mrem/year, occurring in the year 2100. The predicted peak all-pathways dose past the 1,000-year period (through the year 100,000) is 7.2 mrem/year, occurring in the year 3850. The projected groundwater all-pathways dose is well below both the DOE primary dose limit of 100 mrem/year to members of the public and the dose constraint of 30 mrem/year.

A composite analysis also was prepared for the tank farm facility closure. This risk assessment is document in the *Composite Analysis for Tank Farm Closure* (DOE-ID 2003d) and the "Waste Incidental to Reprocessing Determination Report (Draft)."[a] The composite analysis concluded that primary pathway

a. DOE-ID, 2002, "Waste Incidental to Reprocessing Determination Report (Draft)," DOE/ID-10777, U.S. Department of Energy Idaho Operations Office, February 2002.

for the migration of radionuclides from the tank farm is through the underlying Snake River Plain Aquifer.

To provide a conservative estimate of source contribution from the ICDF, the current INTEC soil sources were evaluated at their current location and status.

The tank farm, decontaminated bin sets, CERCLA release sites (INTEC soil), INTEC injection well, and the New Waste Calcining Facility closure were determined to be the major contributors to the INTEC source term. Sites outside of the INTEC facility that also were included in the composite analysis were the TRA warm waste ponds and RWMC.

Simulations of the total contaminant sources from the INTEC facility show that plumes migrate in a general southern direction, consistent with the potentiometric surface map for the regional basalt aquifer. The plumes skirt the edge of RWMC to the east and are then transported off-Site toward the southwest. To ensure that doses from releases upgradient were assessed in light of the doses calculated for RWMC, the maximum dose at the southern INL Site boundary east of RWMC was combined with the doses determined for releases from RWMC, although the plumes are not connected.

The radionuclide plumes modeled in the composite analysis from INTEC and TRA facilities indicate that those plumes would not directly interact with those from RWMC. The contaminant plumes from INTEC and TRA facilities are located east of the RWMC facility. However, since the RWMC plume was not modeled and the overlap of the plumes was not investigated, a conservative approach was taken. The doses from the centerline of the modeled INTEC and TRA plumes at the southern INL boundary were added to the doses reported in the RWMC composite analysis, located at the compliance point 1,000 m (3,281 ft) downgradient of the SDA. The summation of doses in this manner is highly conservative because the maximum doses from each of the contaminant plumes are being added together.

Two receptor locations were considered in the composite analyses: the INTEC receptor and the RWMC receptor. The INTEC receptor was located at the point where the maximum dose would occur from INTEC and TRA releases to the aquifer. The RWMC receptor was located at the point where the summation of the maximum INTEC and TRA groundwater dose would intersect the southern INL boundary.

A maximum all-pathways dose of 2.8 mrem/year was predicted at the INTEC receptor in the year 2600. This dose does not include the contribution from the New Waste Calcining Facility, which had a maximum predicted dose of 4.6 mrem/year in the year 3800 from plutonium. However, the summation of the maximum New Waste Calcining Facility dose of 4.6 mrem/year with the maximum INTEC dose from modeled sources of 2.8 mrem/year results in a total INTEC receptor dose of 7.4 mrem/year. The New Waste Calcining Facility dose was obtained from a very conservative dose study, "Calciner System Screening-Level Risk Assessment for Tank and Piping Residue (Draft),"[b] which assumed all of the contaminants to be located in the soil and not the facility.

The maximum all-pathways dose for modeled sources for the RWMC receptor was predicted to be 1.8 mrem/year in the year 2010. In all cases, the predicted all-pathways dose is significantly below both the DOE primary dose limit of 100 mrem/year and the dose constraint of 30 mrem/year.

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b. EDF-1939, 2001, "Calciner System Screening-Level Risk Assessment for Tank and Piping Residue (Draft)," Idaho National Laboratory, March 2001.

4.4.3.1.3 High-Level Waste Environmental Impact Statement Risk Assessment— The HLW EIS (DOE 2002b) analyzed the potential environmental consequences of alternatives for disposition of HLW calcine, mixed waste and sodium-bearing waste, and newly generated liquid waste at INTEC. The EIS also analyzed alternatives for the final disposition of HLW management facilities at INTEC after their missions are completed.

DOE is required to maintain control on radioactive waste and materials under its jurisdiction until such controls are no longer needed. Nevertheless, for the purposes of analysis in the HLW EIS, it was assumed that institutional controls to protect human health and the environment at the INL would not be in effect after the year 2095. This assumed loss of institutional control means that, at some future date, DOE would no longer control the site and therefore could no longer ensure that unmitigated radioactive doses to the public are within established limits or that actions would be taken to reduce dose levels to as low as reasonably achievable.

The EIS analyzed six waste processing alternatives: No Action, continued current operations, separations (with three treatment options), nonseparations (with four treatment options), minimum INL processing, and direct vitrification (with two treatment options). For disposition of HLW facilities, the EIS analyzed No Action, clean closure, performance-based closure, performance-based closure with grout disposal, and closure to landfill standards. Each of these options is described in detail in the HLW EIS (DOE 2002b).

After considering comments on the draft EIS, as well as information on available treatment technologies, DOE and the State of Idaho identified separate, preferred alternatives for waste treatment. The state's preferred alternative for treating mixed transuranic waste and sodium-bearing waste and calcine is vitrification, as the state felt that was the alternative with the lowest technical and regulatory uncertainty. DOE's preferred alternative for waste treatment is performance-based without a specified technology. Options excluded from DOE's preferred alternative were storage of calcine in the bin sets for an indefinite period under the continued current operations alternative, shipment of calcine to the Hanford Site for treatment under the minimum INL processing alternative, and disposal of mixed LLW on the INL under any alternative.

Both DOE and the State of Idaho identified the same preferred alternative for facilities disposition, which is to use performance-based closure methods for existing facilities and to design new facilities consistent with clean closure methods. Except for the No Action alternative, the rest of the facility disposition alternatives can be implemented in accordance with regulatory requirements. Clean closure and performance-based closure methods differ based on how much contamination can be left in the environment. With clean closure, contaminated residuals must be at or below background levels; with performance-based closure, residual contaminant levels are based on risk. Closure to landfill standards differs from performance-based closure in that design, construction, and operation of the landfill are dictated by specified requirements rather than risk calculations that determine how much can be left in the environment. For landfill closures, regulations require that monitoring be conducted to ensure contaminants have not migrated to the environment at levels that exceed established standards.

For the various alternatives, DOE assessed the environmental impacts for 14 areas of interest for the waste processing alternatives and the facility disposition alternatives. The 14 areas were as follows: land use, socioeconomics, cultural resources, aesthetic and scenic resources, geology and soil, water resources (usage), ecological resources, environmental justice, utilities and energy, air resources, traffic and transportation, health and safety, waste and materials, and facility accidents (off-normal operations). For nine of the 14 areas, the EIS concluded there would be the following little or no impacts associated with any of the alternatives:

- Land use: The maximum additional amount of land that would be converted to industrial use at the INL under the alternatives analyzed in the HLW EIS (DOE 2002b) would be 22 acres.

- Socioeconomics: No significant changes in employment were forecast as a result of the closure alternatives evaluated.

- Cultural resources: Closure activities would occur primarily in previously disturbed areas, and measures are in place to prevent impacts to cultural resources that may be discovered during site development.

- Aesthetic and scenic resources: Construction activities associates with any of the alternatives would be conducted in a manner compatible with the general INL setting and with the BLM visual resource management class designation for the area.

- Geology and soil: Soil and gravel required for the activities would be obtained from existing onsite sources, and impacts to geologic resources would be small.

- Water resources (usage): Total water consumption for one of the alternatives evaluated could increase by as much as 93 million gal/year during operations, but total water usage would still be well below the consumptive-use water rights of 11.4 billion gal/year.

- Ecological resources: Impacts to ecological resources would be small, and there would be no impact to threatened or endangered species or critical habitats. Most activities would take place in heavily developed industrial areas that have marginal value as wildlife habitat.

- Environmental justice: Impacts on population as a whole are expected to be minimal, and no means for minority or low-income populations to be disproportionately affected were identified.

- Utilities and energy: Annual use of fossil fuel could increase by as much as 6.3 million gal and electricity use could increase by as much as 52,000 megawatt-hours (a 59% increase over the 1996 baseline). However, the total required electricity is still less than one-third of the INL electric system capacity.

In five of the areas analyzed, results indicate some impacts, although they are generally small: air resources (increased emissions from construction and waste treatment), traffic and transportation (increased risk of accidents as well as potential for minor radiation exposure during transportation), health and safety impacts to the public and workers, waste generation rates and materials usage, and facility accidents (off-normal operations).

The facility accidents evaluation merits some additional discussion. The HLW EIS evaluated bounding accidents (worst-case events) in terms of radiological dose to workers or the public in terms of release of hazardous materials. The accident scenarios evaluated assumed no mitigation of the release. In reality, the federal government would be required to respond to any radiological emergency at the INL. DOE and other federal agencies would work together to provide resources to assist in the evaluation, mitigation, and cleanup of any accident.

In discussing anticipated risks posed by potential accidents, it should be noted that the longer an operation continues, the longer the window of vulnerability and the larger the probability that the accident will eventually occur. Therefore, the No Action and continued current operations alternatives that do not result in road-ready waste and involve the storage of this waste at INTEC for an indefinite period of time exhibit the longest window of vulnerability and therefore the highest anticipated risk. In fact, the probability of the bounding abnormal accident for the No Action and continued current operations alternatives is a factor of nine more likely than the comparable abnormal accidents for other alternatives that place waste in a road-ready form over a 35-year period.

The largest source of contamination that could reach the public through a groundwater pathway would result from the No Action alternative, where mixed waste and sodium-bearing waste is left in the tank farm and calcine is left in the bin sets. DOE's analysis assumed that after 500 years, the tank farm and bin sets would begin releasing their contents to the soil beneath them. The primary means by which contamination could reach the public would be by leaching through the soil into the aquifer near the facilities. DOE assumed that the maximum individual dose under the No Action alternative would be incurred by a hypothetical future INTEC maximally exposed resident who is assumed to obtain drinking water from a well drilled into the contaminated aquifer. The level of groundwater contamination could be as high as 2,600 pCi/L of technetium-99, resulting in a total lifetime dose from all pathways and all radionuclides of 490 mrem.

Another accident scenario that was evaluated in the HLW EIS (DOE 2002b) was the failure of a degraded bin set in a seismic event after 500 years. For this postulated event, the estimated dose to the population within 50 miles of INTEC was 530,000 person-rem, which would result in 270 latent cancer fatalities. In this scenario, the primary, short-term impact to the maximally exposed individual and the public would be from airborne contamination.

The highest number of lost workdays and recordable injuries would be expected to occur under the clean closure alternative, because of the larger number of workers and duration of disposition activities associated with that alternative. For that alternative, the total lost workdays and recordable injuries were estimated to be 2,500 and 340, respectively. Worker occupational health and safety impacts for all other facility disposition alternatives should be much lower. The clean closure alternative also would generate the greatest amount of waste.

Transportation-related impacts would be greatest for those alternatives that involved transportation of waste from the INL to an off-Site repository or facility for treatment because of the high number of shipments. However, the transportation-related impacts for all alternatives were relatively minor.

DOE included the tank farm and bin sets as part of the analysis of all six facility disposition alternatives because they would contain the majority of the residual radioactivity and would contribute the most to residual risk. Residual risk would vary with the different facility disposition alternatives. For purposes of bounding the analysis, DOE assumed that it would use a single facility disposition alternative (i.e., closure to landfill standards) for closure of most other HLW facilities. The residual radioactive or hazardous material associated with these facilities would be much less than that of the tank farm and bin sets, and the overall residual risk at the INL would not increase substantially because of the contribution from these facilities. For new HLW facilities, DOE analyzed the clean closure alternative.

Additional detailed information is available in the HLW EIS (DOE 2002b).

Table 4-6. Contaminant concentrations and risk levels for sites under institutional control at the Idaho Nuclear Technology and Engineering Center.

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
Group 1 **INTEC Tank Farm.**	Cesium-137, europium-154, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, uranium-235, and technetium-99	To be determined in the OU 3-14 ROD.		To be further defined in the OU 3-14 RI/FS.	To be further defined in the OU 3-14 RI/FS.	To be further defined in the OU 3-14 RI/FS.	To be determined.	Interim actions have been outlined in the OU 3-13 ROD to provide protection until a final remedy is developed and implemented under a separate RI/FS, proposed plan, and ROD under OU 3-14.	Interim actions focus on preventing further leaching of contaminants toward the aquifer. ICs are in place to protect occupational receptors from exposure to radionuclides. ICs will be required if contamination remaining at the site precludes unrestricted land use after completion of remediation.
CPP-15 A soil contamination site that resulted from a leak in a solvent burner tank. This contamination area is approximately 700 ft^2.			Six soil samples were collected in the area of contaminated footing. The major contaminants include cesium-137, plutonium-239/240, and uranium-235.					ICs with surface water control for 10 years.[a] The site was excavated and designated as No Further Action. However, soil contamination has been identified at this site.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-16 Contaminated soil from leak in radiological waste line.			The depth of contamination extends from approximately 5 to 9 ft. The amount of soil contaminated during the spill is estimated at 25 ft^3, containing 1.2 Ci of cesium-137 from the 3,500 gal released. From historical information, estimated contaminants are cesium-137, uranium, and plutonium isotopes and some inorganic constituents.					The soil at the spill was reported to be removed as part of the Idaho Chemical Processing Plant Radioactive Waste System Project during a valve box replacement. ICs with surface water control for 10 years.[a]	
CPP-20 The CPP-604 radioactive waste handling area. Various spills occurred at this site. This area is approximately 225 ft^2.			Contaminated soil with gross radiation readings of 3–5 mR at depths between 30 and 40 ft was identified during upgrade projects in the 1980s. The radionuclides detected at the highest activities, strontium-90 and cesium-137, were analyzed at 330 +/- 3 pCi/g and 114 +/- 1 pCi/g, respectively. Other detected radionuclides had maximum activities no greater than 2.2 pCi/g.					ICs with surface water control for 10 years.[a]	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-24 Tank Farm area bucket spill. This site consists of an area approximately 18 ft^2. In 1954, approximately 1 gal of radioactively contaminated solution was spilled from a bucket onto the ground.			Logbooks indicate that the spilled material was removed, but the exact location of this spill is not known. Radiation surveys in the area have revealed no radiation levels above background.					ICs with surface water control for 10 years.[a]	
CPP-25 Contaminated soil. In 1960, a transfer line ruptured, and an unknown quantity of liquid waste was released. This area is approximately 500 ft^2.			No known sampling has been done at Site-25.					ICs with surface water control for 10 years.[a] Some soil was removed, and the area was excavated and backfilled with low-level, radiologically contaminated soil.	
CPP-26 Contaminated soil from steam flushing operations. 13 acres inside the fence and 3 acres outside the fence of soil were contaminated from an incident that occurred in 1964. This area is approximately 12,850 ft^2.			The radionuclides detected in the soil during a Track 2 investigation consist primarily of strontium-90, cesium-137, and europium-154 and lower levels of plutonium-238, plutonium-239, and americium-241.					ICs with surface water control for 10 years.[a]	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-27 Contaminated soil. Contamination resulted from leaks caused by acidic condensate in two pressure-relief lines. This site, with CPP-33, covers an area of approximately 2,000 ft^2.			Contaminants include arsenic, chromium, americium-241, cesium-137, cesium -134, europium-154, neptunium-237, plutonium-238, plutonium-239/240, strontium-90, and uranium-235. Another source of contamination is suspected because the contamination found in a borehole was at a more shallow depth than the leaking vent line, and the contamination is in the area that has not been disturbed by excavation.					ICs with surface water control for 10 years.[a] This site was discovered in 1964. Remediation was performed, but hot spots still exist.	
CPP-28 Subsurface contamination exists from a hole in a transfer line. It is estimated that 3,600 gal of first-cycle raffinate waste were released from this pipe between 1955 and 1974. This site is one of the most significant release sites from a radiological perspective.			Site CPP-28 may have transuranic concentrations greater than 100 nCi/g in the soil.					ICs with surface water control for 10 years.[a]	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-30 Contaminated soil in the Tank Farm area.			No known sampling has been done at site CPP-30.					This site was recommended in a Track 2 investigation as a No Further Action site because the entire area has been excavated in the past and the contaminated soil was reportedly removed and disposed of at the RWMC. ICs with surface water control for 10 years.[a]	
CPP-31 Contaminated soil in the Tank Farm area. The source of contamination was a corroded carbon-steel radioactive liquid waste line.			The estimated volume of contaminated soil is 5,403 ft^3 in a 10-R/hour range and 10,806 ft^3 in a 1-R/hour range.					ICs with surface water control for 10 years.[a]	
CPP-32 Two areas of soil contamination that were contaminated by pipe leaks. This area is approximately 8 ft^2 and extends to a depth of about 1 ft below ground.			During field testing, the highest beta-gamma radiation reading, 900 counts/minute above background, was detected between 1.4 and 2.9 ft (roughly equivalent to the ground surface at the time of release).					ICs with surface water control for 10 years.[a]	
CPP-33 An area of contaminated soil from a Tank Farm Facility valve leak. This site is addressed under site CPP-27.			Not available.					ICs with surface water control for 10 years.[a] Soil removal actions were implemented, but some contaminated soil was left in place.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-58 Two contaminated sites (58E and 58W) that resulted from PEW evaporator overhead pipe spills. The releases at CPP-58W occurred in 1954; INTEC-649 subsequently was constructed over the site. The total contaminated area was approximately 6,800 ft^2.			For site CPP-58E, sampling and analysis showed cesium-137 and strontium-90 as present above background levels. Site 58W has not been characterized because of the building, but it is assumed that results of the investigation of CPP-58E are representative.					ICs with surface water controls for 10 years.[a]	
CPP-79 A release site where 2,500 gal of low-level, radioactively contaminated condensate were released in 1976.			Sampling of this release site indicated contamination at 36 ft and higher levels of contamination at 40–42 ft below ground surface. All samples were analyzed for gross alpha- and gross beta-emitting radionuclides, with the exception of the deepest samples, which was too radioactive to analyze. Results can be found in the *Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Feasibility Study Work Plan* (DOE-ID 2004g, p. 3-31).					ICs with surface water controls for 10 years.[a]	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-96 Additional soil. This area is approximately 79,696 ft^2.			There is limited data for CPP-96. In September 1995, construction personnel encountered elevated radiological readings while conducting an excavation at site CPP-15. Following cleanup at sites CPP-27 and CPP-33, it is estimated that 25 mCi of radioactivity in the soil remained in place. Results of the gamma analysis for site CPP-58 detected only cesium-137 and potassium-40 with contamination estimated to be present from 6 to 46 ft below grade.					ICs with surface water controls for 10 years.[a]	
Group 2 **Soil under Buildings and Structures.**	Americium-241, cesium-137, cobalt-60, iodine-129, neptunium-237, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, technetium-99, uranium-235, tritium, mercury, arsenic, and chromium	Radionuclides (residential): americium-241 (290 pCi/g), cesium-137 (23 pCi/g), europium-152 (270 pCi/g), europium-154 (5,200 pCi/g), plutonium-238 (670 pCi/g), plutonium-239 and plutonium-240 (250 pCi/g), plutonium-241 (56,000 pCi/g), and strontium-90 (223 pCi/g). Nonradionuclides (residential): mercury (human health) (23 mg/kg).		As defined in the OU 3-13 BRA (Part A).	As defined in the OU 3-13 BRA (Part A).	As defined in the OU 3-13 BRA (Part A).			ICs are in place to limit access to only authorized personnel or DOE-certified remediation workers.

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-02 An old French drain. An estimated 493 Ci was released with the major isotope being tritium. The graphite fuel storage building was constructed over this site.	Unknown	Not available.	The site has not been sampled. Currently, the leaching of contamination is being controlled by the building limiting infiltration.	See Footnote b.	See Footnote b.	See Footnote b.		ICs with containment caps being designed for 1,000 years. Discharge was discontinued in 1966, and the drain was dispositioned.	
CPP-41 Fire training pits. These two small depressions (1,400 ft^2 and 1,600 ft^2) were used to burn organic material to train firefighters. CPP-41A has been covered with asphalt, and because it is close to building CPP-663, it is suspected of having been excavated and removed during construction of CPP-663.	Not available	Not available.	Not available.	Not available.	Not available.	Not available.		A No Further Action recommendation was submitted. ICs with containment caps being designed for 1,000 years.	
CPP-60 Soil beneath the former paint shop building. Building CPP-645 is now over this site.	Not available	Not available.	No samples were collected to confirm the existence or absence of contamination at this site.	Not available.	Not available.	Not available.		ICs with containment caps being designed for 1,000 years.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-68 Former location of an abandoned, 500-gal, underground gasoline storage tank.	Not available	Not available.	A single sample of the tank bed soil was analyzed and found to contain only traces of gasoline organic constituents that did not exceed risk-based levels. In addition, visual examination of the tank bed soil did not suggest tank leakage.	Not available.	Not available.	Not available.		ICs with containment caps being designed for 1,000 years.	
CPP-80 A hazardous, radioactive liquid condensate leak from the building CPP-601 vent tunnel drain. From 1983 to 1989, approximately 105,000 gal of hazardous, radioactive liquid condensate were released to the soil.	Unknown	Not available.	No soil sampling was performed because of the inaccessibility of the site.	See Footnote c.	See Footnote c.	See Footnote c.		ICs with containment caps being designed for 1,000 years.	
CPP-85 Waste Calcining Facility blower corridor for the INTEC-633 cells.	Cesium-137	23 pCi/g.	No samples were taken from inside the corridor, but samples collected from the blower pit downstream showed the presence of various fission products including cesium-137 at 49,600 pCi/g. Video inspection of the corridor interior taken in 1994 did not show any evidence of deterioration of the pipeline; therefore, there is no evidence of contamination on, or migration of, contaminants from the CPP-85 blower corridor.	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from soil ingestion (americium-241, cesium-137, and strontium-90), homegrown produce ingestion (cesium-137 and strontium-90), and external radiation exposure (cesium-137).		ICs with containment caps being designed for 1,000 years.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-86 A waste trench that runs beneath CPP-602. The trench, which lies approximately 10 ft below ground, collects liquid waste for transfer to the PEW evaporator from various CPP-602 operations.	Mercury	>10X background or HI >1.	During modification of the trench in 1990, mercury was found in a sample of sludge and dirt that originated from the base of the trench.	Not available.	Not available.	Not available.		ICs with containment caps being designed for 1,000 years.	
CPP-87 Soil beneath INTEC–604 vessel off-gas blower core. A portion of the blower cell concrete is severely deteriorated.	Not available	Not available.	Analysis of a soil sample below a severely deteriorated portion of the concrete in the blower cell indicated the presence of low concentrations of hazardous constituents. The results of the sample analysis that indicate contaminant concentrations are below extraction procedure toxicity limits.	No identified route for contamination transport to the aquifer. Site is not included in the groundwater model.	No identified route for contamination transport to the aquifer. Site is not included in the groundwater model.	No identified route for contamination transport to the aquifer. Site is not included in the groundwater model.		The scoping package recommended this site for No Further Action. ICs with containment for 1,000 years.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-89 INTEC-604 and INTEC-605 tunnel excavation. Contamination resulted from leaks in the abandoned drain lines to the PEW system. Contaminated soil was encountered during excavation. Contaminated soil was boxed and removed. Contamination was also encountered on the outside south-facing basement wall of CPP-604 and is believed to be the result of a leaking concrete sump above the wall in CPP-604.	Unknown	Not available.	The excavated soil placed in boxes is currently stored at site CPP-92. No effort was made to remove all of the contaminated soil. Soil remaining in place has not been sampled. The boxed soil was sampled, and identified contaminants are consistent with soil contamination resulting from release of service waste and PEW evaporator condensates that typically include nitric acid, mercury, plutonium, cesium-137, and strontium-90.	See Footnote d.	See Footnote d.	See Footnote d.		Some soil has been removed. ICs with containment caps being designed for 1,000 years.	Groundwater concern only.

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
Group 3 **Other Surface Soil Sites.**	Americium-241, cesium-137, cobalt-60, europium-152, europium-154, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, uranium-235, mercury, lead, and chromium	Radionuclides: americium-241 (290 pCi/g), cesium-137 (23 pCi/g), europium-152 (270 pCi/g), europium-154 (5,200 pCi/g), plutonium-238 (670 pCi/g), plutonium-239 and plutonium-240 (250 pCi/g), plutonium-241 (56,000 pCi/g), and strontium-90 (223 pCi/g). (2) nonradionuclides: mercury (human health) (23 mg/kg).							ICs are in place to limit access to only authorized personnel or DOE-certified remediation workers.
CPP-01 A concrete horizontal settling basin, concrete vertical settling pit, and two dry wells. The basin and wells were used for discharge of radioactively contaminated fuel storage basin water. Use of these facilities ceased in 1977.	Unknown	Not available.	Depth of contamination is assumed to extend from ground surface to the sediment-basalt interface at 32 ft below ground. Additional detail can be found in the OU 3-13 ROD (Table 5-7, p. 5-26).	Not available.	Not available.	Not available.		The total volume (5,000 gal) of sludge and liquid in the horizontal settling basin and the vertical settling pit was removed in 1993 under a Comprehensive Environmental Response, Compensation, and Liability Act removal action. The liquid removed was sent to the PEW facility, and the sludge was dried and sent to the RWMC.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-03 A storage site for radiologically contaminated equipment.	Cesium-137	23 pCi/g.	Cesium-137 was detected at activity levels greater than background in all six surface or near-surface samples collected at site CPP-03. Cesium-137 exceeds the ROD-defined remediation goal of 23 pCi/g.	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	1-in-10,000 surface risk >1,000,000 from radiation exposure (cesium-137).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).		Some contaminated soil was removed; however, the site is still radiologically contaminated.	
CPP-04 and CPP-05 Soil contamination associated with the two sites resulted from unintentional releases during sludge removal from the horizontal settling basin CPP-740 and the vertical settling pit CPP-301 in 1978. The contaminated area was later covered with 2 ft of soil.	Unknown	Not available.	Cesium-137 contamination is above background levels ranging from 0.0219 to 26,500 pCi/g. Assuming an average depth of contamination of 2 ft, the total volume of contaminated soil is estimated at 8,844 ft^3. Additional detail can be found in OU 3-13 ROD (Table 5-12, p. 5-34).						
CPP-08 and CPP-09 Contamination resulted from basin system line failures and the soil contamination discovered near the northeast corner of the CPP-603 basin.			No soil samples have been collected. The assumed depth of contamination is 31 ft, with an estimated contaminated soil volume of 83,700 ft^3. Additional detail can be found in the OU 3-13 ROD (Table 5-9, p. 5-29).	Surface risk >1 in 10,000 from external radiation exposure (cobalt-60, cesium-134, cesium-137, europium-152, and europium-154).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137 and europium-152).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137, europium-152, and europium-154).		ICs, removal, and onsite disposal in the ICDF.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-10 Area that resulted from a release of approximately 800 gal of radionuclide-contaminated basin water that drained onto a shielded floor area from a break in a polyvinyl chloride line in December 1976.			No remedial actions were performed at this site other than placing several inches of clean soil over the contaminated area. Contamination is assumed to extend from ground surface to the soil-basalt interface at 34 ft below ground. Additional detail can be found in the OU 3-13 ROD (Table 5-10, p. 5-30).	Surface risk >1 in 10,000 from external radiation exposure (cobalt-60, cesium-134, cesium-137, europium-152, and europium-154).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137 and europium-152).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137, europium-152, and europium-154).		ICs, removal, and onsite disposal in the ICDF.	
CPP-11 Resulted from a release of contaminated sludge and water in February 1978. Approximately 300–500 gal of sludge and water was released and covered an area of 28 × 56 ft. The initial spill was cleaned up, and soil with radiation levels greater than 1 R/hour was removed. Tank SFE-06 is located 6 ft below ground at this site and is still used for storage of radionuclide-contaminated waste. The tank is not known to be leaking.			Radionuclide activities were still above background levels at 12 ft below ground. The areal extent of the site is 2,240 ft^2. The total estimated contaminated soil volume is 40,390 ft^3. Additional detail can be found in the OU 3-13 ROD (Table 5-11, p. 5-31).	Surface risk >1 in 10,000 from external radiation exposure (cobalt-60, cesium-134, cesium-137, europium-152, and europium-154).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137 and europium-152).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137, europium-152, and europium-154).		ICs, removal, and onsite disposal in the ICDF. The initial spill was cleaned up, but the site is still radiologically contaminated.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-13 Contamination located on an earthen berm covering underground storage Bin Set 3, which contains calcined high-level radioactive waste. The contamination was caused by an airborne release of calcined high-level waste in 1976.			Surface soil from the bin set area contains radioactivity levels ranging between 800 and 3,000 counts/minute. The contamination over the berm area was left in place and covered with approximately 6 in. of clean soil. The zone of contamination is assumed to extend throughout the estimated 25-ft-high berm to approximately 2.5 ft below the base of the berm (original ground surface). The area of CPP-13 is estimated at 3,949 ft^2. Additional detail can be found in the OU 3-13 ROD (Table 5-15, p. 5-41).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137 and europium-154).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from homegrown produce ingestion (strontium-90) and external radiation exposure (cesium-137).		ICs, removal, and onsite disposal in the ICDF. Cap will be designed for 1,000 years.	
CPP-14 The site of a decommissioned sewage treatment plant that operated from 1951 through 1982. The site comprises a drainfield, Imhoff tanks, and the plant.	Mercury	>10X background or HI >1.	The extent of contamination was evaluated based on the results of sampling. The zone of contamination in the area of the Imhoff Tanks is assumed to be 3 ft thick and extends from 8 to 11 ft below ground. This thickness is based on the initial depth at which sludge was encountered during sampling and the depth of the base of the tanks. The area of the tanks is 200 ft^2. Cesium-137, neptunium-237, and strontium-90 were detected at activities above 1 pCi/g. Cesium-137 activity ranged as high as 6.21 pCi/g. The zone of				Poses solely an ecological risk.	ICs, removal, and onsite disposal in the ICDF.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
			contamination at the plant site was assumed to be 27 ft thick. This zone extends from 5 to 32 ft below ground. The area measures 9,860 ft^2. The zone of contamination at the drain field is assumed to extend to 25 ft below ground. The area is estimated to be 3,300 ft^2. Neptunium-237 was detected at a maximum activity of 1.4 pCi/g.						
CPP-19 Resulted from a 1978 release of 2,000 gal of radionuclide-contaminated liquid that leaked from an underground waste transfer line.	Cesium-137 and strontium-90	23 pCi/g and 223 pCi/g.	Cesium-137, strontium-90, and isotopes of europium are the most widespread and are found at the highest levels. Cesium-137 activity was as high as 408,000 pCi/g. Contamination was detected at activity levels above background in samples collected just above the soil-basalt interface at approximately 31 ft below ground. The zone of contamination is assumed to extend from the ground surface to the soil-basalt interface. The area of site CPP-19 is estimated to be 3,300 ft^2. Additional detail can be found in OU 3-13 ROD (Table 5-16, p. 5-43).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	1-in-10,000 surface risk >1 in 1,000,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from soil ingestion (cesium-137 and strontium-90), homegrown ingestion (cesium-137 and strontium-90), and external radiation exposure (cesium-137, europium-152, and europium-154).		ICs, removal, and onsite disposal in the ICDF. Soil was removed, but boreholes indicate contamination at depth.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-34 A soil storage trench in the northeast corner of INTEC. In 1984, radionuclide-contaminated soil at levels up to 30 mR/hour was removed from CPP-33 to CPP-34.	Cesium-137 and strontium-90	23 pCi/g and 223 pCi/g.	The highest concentrations of cesium-137 and strontium-90 are primarily at depths between 6 and 12 ft and extend downward to 16 ft. Concentrations of these radionuclides decrease with depth but are still above background at 18–20 ft in most areas. The zone of contamination assumed for this site is from 0 to 20 ft. The volume of soil was estimated to be 738,500 ft^3. An average width of the trench (35 ft) was used to calculate soil volumes. Cesium-137 concentrations exceeded the remediation goal of 23 pCi/g. Strontium-90 exceeded its remediation goal of 223 pCi/g. Additional detail can be found in the OU 3-13 ROD (Table 5-14, p. 5-39).	1-in-10,000 surface risk >1 in 1,000,000 from external radiation exposure (cesium-137).	1-in-10,000 surface risk >1 in 1,000,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from homegrown produce ingestion (strontium-90) and external radiation exposure (cesium-137).		ICs, removal, and onsite disposal in the ICDF.	
CPP-35 The INTEC-633 decontamination spill caused when decontamination solution entered the air transport system and was released to the soil. This release was estimated to have a contaminated area of 1,200 ft^2. The release was			Cesium-137, strontium-90, and mercury contaminants were detected above background level. No contaminants were detected below 7 ft.	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from soil ingestion (americium-241, cesium-137, and strontium-90), homegrown produce ingestion (cesium-137 and strontium-90), and external radiation exposure (cesium-137).		ICs, removal, and onsite disposal in the ICDF. Contaminated soil and gravel were removed and shipped to the RWMC for disposal; however, contamination still exists at the site.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
approximately 10 gal of solution containing nitric acid, mercuric nitrate, heavy metals, fluoride, nitrates, and as much as 10 Ci of total activity.									
CPP-36 The result of three separate releases: (1) In 1970, highly contaminated soil (up to 20 R/hour) was encountered at a depth of 6 ft beneath Olive Avenue. The exact location of the release source is unknown; (2) In 1974, contamination was encountered under Olive Avenue during excavation for installation of lines; and (3) In 1974, 750 gal of solution containing an estimated 4 Ci of total activity leaked into a valve pit.	Unknown		Based on the results of investigations, the zone of contamination is assumed to extend from the ground surface to the soil-basalt interface at about 42 ft. This depth is based on high-activity levels measured in the deepest samples collected from borings. Results from observation wells show elevated radiation levels to at least 25 ft below ground. Cesium-137, strontium-90, and mercury were detected above background levels.	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from soil ingestion (americium-241, cesium-137, and strontium-90), homegrown produce ingestion (cesium-137 and strontium-90), and external radiation exposure (cesium-137).		ICs, removal, and onsite disposal in the ICDF. Contaminated soil and gravel were removed; however, contamination still exists at this site.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-37 Site CPP-37A consists of Gravel Pit 1. Site CPP-37B consists of Gravel Pit 2. Gravel Pit 1 was used for decontamination of radiological contaminated construction equipment in 1983. This pit received storm water run-off from INTEC until August 2003. Gravel Pit 2 was backfilled. Before 1982, this pit was often used for the disposal of water released from the sludge dewatering pit of the Old Sewage Treatment Plant.	Not applicable	COCs for both sites do not exceed the remediation goals.	Not applicable.					For CPP-37A, the remedy was "excavate and dispose at the ICDF." This decision was based on available data at the time of development of the OU 3-13 ROD. Data at that time were not complete as they did not include europium-152, europium-154, and plutonium-241 COCs. Using a cesium-137 scaling factor, it is now possible to provide information on these COCs. In review of this new information, the COCs do not exceed the OU 3-13 remediation goals. The presumptive remedy of excavation and disposal at the ICDF is not needed, as the cleanup levels are currently met. This new information will be documented in the Phase I Completion Report and the Remedial Action Report. No remediation goals were exceeded for any samples at CPP-37B.	
CPP-44 Grease pit.	Chromium III, Chromium VI, lead, mercury, and decanal		Detail can be found in the OU 3-13 ROD (Table 5-22, p. 5-62).	Has an ecological HI greater than 1.	Has an ecological HI greater than 1.	Has an ecological HI greater than 1.	Poses solely an ecological risk.	ICs, removal, and onsite disposal in the ICDF.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-48 An excess chemical dump tank that was used as a French drain from 1975 to 1981. Before installation of the excess chemical dump tank in 1975, waste chemicals were disposed of directly in the soil in a trenchlike depression located at the dump tank site. In 1993, the dump tank was dismantled, packaged, and removed to the Waste Experimental Reduction Facility for disposal.			Four soil samples were taken at the bottom of the dump tank excavation (10 ft and 12 ft below ground) to determine possible soil contamination in the underlying soil. Samples were analyzed for kerosene, VOCs, semi-VOCs, RCRA metals, and radionuclides. Kerosene, VOC, and semi-VOC constituents were not detected. Analysis for radionuclide contamination showed a cesium-137 concentration highest at 12 ft below ground, an Antimony-125 concentration at 10 ft, and the highest europium-155 concentration at 12 ft below ground. Additional detail can be found in the OU 3-13 ROD (Table 5-21, p. 5-59).					ICs, removal, and onsite disposal in the ICDF.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-55 An area contaminated with paint solvents. Mercury contamination area.	Arsenic, Chromium III, Chromium VI, lead, mercury, nickel, selenium, and silver		Chromium is not expected to persist in the environment in the Chromium VI form. Mercury remains a concern with a maximum concentration of 5.2 mg/kg. The next highest was 0.62 mg/kg. It is highly probable that the one sample having the high hit was a small hot spot that would not contribute that greatly to average exposure. Additional detail can be found in the OU 3-13 ROD (Table 5-23, p. 5-63).	Not applicable.	Not applicable.	Not applicable.	Poses solely an ecological risk. Has an ecological HI greater than 1 from exposure to metals (arsenic, chromium III, chromium VI, lead, mercury, nickel, selenium, and silver).	ICs, removal, and onsite disposal in the ICDF.	
CPP-67 CPP Percolation Ponds 1 and 2, which were used for the discharge of service waste from 1984 to 2001.	Americium-241, cesium-137, europium-152, europium-154, plutonium-238, plutonium-239/240, plutonium-241, and strontium-90	290 pCi/g; 23 pCi/g; 270 pCi/g; 5,200 pCi/g; 670 pCi/g; 250 pCi/g; 56,000 pCi/g; and 220 pCi/g.	Activities for all radionuclides detected decreased with depth, with the exception of plutonium-239/240. Plutonium-239/240 increased slightly from 0.27 to 0.5 pCi/g. All other radionuclides detected in surficial samples decreased to below detection or below background levels, except neptunium-237. Cesium-137 exceeded the ROD-identified remediation goal of 23 pCi/g in surface samples at all sample locations. Additional detail can be found in the OU 3-13 ROD (Table 5-13, p. 5-35).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	1-in-10,000 surface risk >1 in 1,000,000 from external radiation exposure (cesium-137 and neptunium-237).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).		Excavation of contaminated soil with disposal in the ICDF. Remediation is complete.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-91 The INTEC-633 blower pit drain. This drain discharged directly to the soil; it was sealed after initial cleanup activities in 1992.	Cesium-137, cesium-134, cobalt-60, europium-154, and mercury		A sample of the dirt on the blower pit floor showed elevated levels of cesium-137, cesium-134, cobalt-60, europium-154, and mercury. This suggests that releases of radionuclide contamination may have occurred through the blower pit drain to the underlying soil over the 25+ years since the Waste Calcine Facility became operational.	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from external radiation exposure (cesium-137).	Surface risk >1 in 10,000 from soil ingestion (americium-241, cesium-137, and strontium-90), homegrown produce ingestion (cesium-137 and strontium-90), and external radiation exposure (cesium-137).		ICs, removal, and onsite disposal in the ICDF.	
CPP-92 This site consists of 653 boxes containing soil (571 boxes) and soil/debris (82 boxes) that were generated from various INTEC plant projects.			Boxed soil was sampled and analyzed for VOCs, semi-VOCs, inorganics, and radionuclides. Neither VOCs nor semi-VOCs were detected in the samples. The only inorganics detected above background were arsenic at 5.9 mg/kg and mercury at 10.4 mg/kg. Radionuclides were detected above background in the samples at the following maximum concentrations: americium-241 (23.6 pCi/g), cesium-137 (7,730 pCi/g), plutonium-238 (259 pCi/g), plutonium-239/240 (24.7 pCi/g), strontium-90 (10,800 pCi/g), uranium-234 (5.1 pCi/g), and iodine-129 (3.1 pCi/g).	The waste boxes that contain radioactive soil were not evaluated quantitatively in the RI/BRA.	The waste boxes that contain radioactive soil were not evaluated quantitatively in the RI/BRA.	The waste boxes that contain radioactive soil were not evaluated quantitatively in the RI/BRA.		ICs, removal, and onsite disposal.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-93 Simulated calcine disposal trench used to dispose of simulated calcine test batches before hot startup of the Waste Calcine Facility. None of the test batches contained radionuclides; however, one test batch contained mercuric nitrate.	Mercury, aluminum, nitrate, and sodium		Sampling and analysis identified mercury, aluminum, nitrate, and sodium as contaminants. The contaminated zone is assumed to be from 2.5 to 25 ft. A volume of contaminated soil of 72,000 ft^3 was estimated based on reported dimensions of the trench. Additional detail can be found in the OU 3-13 ROD (Table 5-17, p. 5-46).	Not applicable.	Not applicable.	Not applicable.	This site is being addressed as an ecological risk site because of ingestion of homegrown produce.	ICs, removal, and onsite disposal.	
CPP-97 Includes two tarp-covered soil stockpiles and the contaminated surface soil surrounding the piles. The piles were generated from waste soil that originated from the tank farm upgrade project conducted during 1993, 1994, and 1995.	Cesium-137	23 pCi/g.	Results of in situ gamma spectrometry measurements indicated that cesium-137 concentrations ranged from 2.3 to 106 pCi/g, with some of the high measurements detected near the IC boundary.	Not evaluated.	Not evaluated.	Not evaluated.		ICs, removal, and onsite disposal.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-98 Containerized waste consisting of 119 boxes of debris located in the southwest portion of INTEC. These boxes contain wooden shoring used during the tank farm upgrade project. Because the tank farm soil was contaminated, the shoring also became contaminated and was placed into wooden waste boxes lined with a polyethylene membrane.	Not available	Not available.	No analytical data are available for the contaminated wooden shoring used during the tank farm upgrade project. Data are available for the corresponding contaminated soil that was excavated as part of the same project (site CPP-97). Therefore, the soil data from site CPP-97 are assumed to be representative of the expected contamination on the containerized debris.	Not analyzed.	Not analyzed.	Not analyzed.		ICs, removal, and onsite disposal.	
CPP-99 A group of boxes located in the southwest portion of INTEC. This site consists of 58 boxes containing radionuclide-contaminated soil (14 boxes), soil/debris (43 boxes), and unknown contents (1 box) generated from the tank farm upgrade and emergency fire tunnel excavation projects. The boxes are 2 × 4 ×	Not available	Not available.	No analytical data are available. Data are available for the corresponding contaminated soil that was excavated as part of the same project (sites CPP-97 and CPP-92). Therefore, the soil data from sites CPP-97 and CPP-92 are assumed to be representative of site CPP-99. Additionally, data also are available for the excavated soil from the excavation for the fire exit from site CPP-92 and are assumed to be representative of site CPP-99 as well.	Not analyzed.	Not analyzed.	Not analyzed.		ICs, removal, and onsite disposal.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
8 ft and 4 × 4 × 8 ft wooden waste boxes lined with a polyethylene membrane.									
Group 4 **Perched Water.** Perched water consists of water in the vadose zone that is saturating sediment or basalt above the regional aquifer.	Strontium-90, tritium, nitrate, and arsenic	8 pCi/L, 20,000 pCi/L, 10 mg/L, and 0.05 mg/L.	The principal contaminants that exceed MCLs in the perched water are strontium-90, tritium, and nitrate. Of the 22 perched wells sampled in the year 2004, 11 wells exceeded the MCL for strontium-90, three wells exceeded the MCL for tritium, and seven wells exceeded the MCL for nitrate. Arsenic and chromium each exceeded their respective MCLs in just one perched well during the year 2004.	Potential source of groundwater contamination. Site is included in the groundwater model.	Potential source of groundwater contamination. Site is included in the groundwater model.	Potential source of groundwater contamination. Site is included in the groundwater model.		ICs with aquifer recharge control.	Groundwater concern. ICs are in place to prevent consumption and use of contaminated water.
Group 5 **Snake River Plain Aquifer.**	Before 2095: strontium-90, iodine-129, neptunium-237, tritium, chromium, mercury, and technetium-99	Remediation goals for INTEC-derived COCs present in the Snake River Plain Aquifer groundwater outside the current INTEC security fence are based on the applicable State of Idaho "Ground Water Quality Rule" (IDAPA 58.01.11).							ICs are in place to prevent consumption and use of contaminated water.

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-23 The CPP Injection Well (MAH-FE-304). The injection well was used from 1952 to 1986 to dispose of service wastewater, including cooling water and condensate. The primary contaminants in the wastewater were radionuclides. Tritium was the primary radionuclide released to the aquifer and comprised about 96% of the total contaminant activity.			The injected wastewater also contained other (nonradioactive) chemicals at concentrations below federal and state groundwater quality standards, except for mercury, which is estimated to exceed groundwater quality standards in the immediate vicinity of the former injection well. Subsequent contaminant migration has produced a large contaminant plume in the aquifer with relatively low concentrations of tritium, strontium-90, and iodine-129, which occurs beneath and several miles south of the Idaho Chemical Processing Plant.	See Footnote e.	See Footnote e.	See Footnote e.			Groundwater concern.
Group 6 **Buried Gas Cylinders.**	Fluoride								
CPP-84 Buried gas cylinders.		Removal of cylinders.	Not available.					Removal is in progress, to be completed by the end of 2004.	Safety risk.
CPP-94 Buried gas cylinders.	Buried gas cylinders	Removal of cylinders.	Not available.				No.	Cylinders were removed, and confirmatory sampling has been completed. This site will be graded and revegetated in 2004.	ICs to be discontinued in next 5-year review.

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
Group 7 **SFE-20 Hot Waste Tank System.**	Cesium-137, cesium-134, cobalt-60, strontium-90, isotopes of europium, isotopes of plutonium, and uranium								ICs are in place to prevent intrusion.
CPP-69 Consists of an abandoned liquid radioactive waste storage tank (SFE-20) and its contents. The tank contains 400 gal of low-level waste and has been out of service since 1977. It represents a potential release site, though no release has occurred.			An investigation conducted in 1984 indicated that the tank contained elevated levels of cesium-137, cesium -134, cobalt-60, strontium-90, and isotopes of europium, plutonium, and uranium. There are no data available for nonradioactive constituents; however, the tank contents may contain inorganic and organic constituents that were associated with the operation of the spent fuel storage pool filtration system. Soil beneath the tank vault has not been sampled because of inaccessibility. There is no evidence that the vault has leaked.	See Footnote f.	See Footnote f.	See Footnote f.		ICs, removal, and treatment and disposal in the ICDF.	ICs to prevent intrusion into underlying tank system. Access is limited to only authorized personnel or DOE-certified radiation workers.

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
No Further Action Sites.									ICs are in place to limit access to only authorized personnel or DOE-certified remediation workers.
CPP-06 Trench east of the INTEC-603 fuel storage basin. The trench was used for the discharge of basin water when maintenance was conducted on the basin. The water discharged was reported to contain radionuclides at or near background concentrations.	Not available	Not applicable.	Only one sample was collected from the trench. Results are not readily available.	A risk assessment performed using limited data indicated acceptable risks in the year 2095 but unacceptable risks in the year 2000.	A risk assessment performed using limited data indicated acceptable risks in the year 2095 but unacceptable risks in the year 2000.	A risk assessment performed using limited data indicated acceptable risks in the year 2095 but unacceptable risks in the year 2000.		No Further Action site.	
CPP-17 Consists of two areas east of INTEC-603 and south of the INTEC peach bottom fuel storage area. The areas were used for storage of sludge and liquids from INTEC-603 fuel storage basin maintenance activities, which resulted in contamination of the underlying soil.	Not available	Not applicable.	Three soil borings were sampled to characterize CPP-17. Results are not readily available.	Risks to current onsite workers and hypothetical future residents are acceptable, but the current residential risks are unacceptable.	Risks to current onsite workers and hypothetical future residents are acceptable, but the current residential risks are unacceptable.	Risks to current onsite workers and hypothetical future residents are acceptable, but the current residential risks are unacceptable.		No Further Action site.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-22 Resulted from a radioactive particle release from failed cell ventilation filters in 1958. At the time of release, approximately 130,949 ft^2 of land next to and south of INTEC-603 were contaminated. Contamination from this airborne release has most likely been removed or covered over with soil during the period from 1958 to the present as a result of construction activities that have disturbed the area.	Cesium-137	23 pCi/g.	The area was extensively surveyed, and three boreholes were drilled within site CPP-22 at the locations surveyed to have the highest radiation levels above background. During the investigation, the peak concentration for cesium-137 was 14 pCi/g.	Future risks are acceptable, but the current residential risks are not acceptable.	Future risks are acceptable, but the current residential risks are not acceptable.	Future risks are acceptable, but the current residential risks are not acceptable.		No Further Action site.	
CPP-61 A small area of soil contamination, approximately 624 ft^2, which was primarily associated with a PCB release. Approximately 400 gal of PCB oil was spilled. The release site is located in the CPP-718 transformer yard.	PCBs	400 ppm.	Three soil borings were drilled and soil samples analyzed for radionuclides. The radionuclides found were below risk-based soil concentrations.	Not available.	Not available.	Not available.		Soil contaminated with PCBs was removed, and a new transformer and pad were installed.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
CPP-88 Consists of radioactively contaminated soil within the current INTEC security fence that has not been attributed to another specific release site.	Cesium-137	23 pCi/g.	Analysis of samples collected from 16 boreholes from various INTEC locations. The maximum cesium-137 concentration was 36.6 pCi/g.	Above the current 1-in-10,000 residential risk range and below the year 2095 1-in-10,000 residential risk range.	Above the current 1-in-10,000 residential risk range and below the year 2095 1-in-10,000 residential risk range.	Above the current 1-in-10,000 residential risk range and below the year 2095 1-in-10,000 residential risk range.		No Further Action sites. ICs for 100 years (year 2095).	
CPP-90 Contamination resulted from the deterioration of a service waste line, which washed contaminated soil into the CPP disposal well.	Cesium-137	23 pCi/g.	Soil analytical data from three soil borings indicate a maximum cesium-137 concentration of 7.5 pCi/g.	The future residential risk is acceptable, but the current residential risk is not acceptable.	The future residential risk is acceptable, but the current residential risk is not acceptable.	The future residential risk is acceptable, but the current residential risk is not acceptable.		No Further Action site. ICs for 100 years (year 2095).	
CPP-95 The windblown plume that consists of areas outside the current INTEC perimeter fence that are potentially contaminated as a result of wind dispersion of radionuclides from facility operations.	Cesium-137	23 pCi/g.	The contamination is probably restricted to the top 9 in. of soil. Concentrations vary with the distance from the facility; the extent is determined by cesium-137 concentration of 6 pCi/g.	The future residential risk is acceptable, but the current residential risk is not acceptable.	The future residential risk is acceptable, but the current residential risk is not acceptable.	The future residential risk is acceptable, but the current residential risk is not acceptable.		No Further Action site. ICs for 100 years (year 2095).	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
Sites Addressed under Other Waste Area Groups or Regulatory Programs.									
CPP-38 Asbestos in nine INTEC buildings.	Asbestos	Not applicable.	Track 1 decision document determined that the asbestos is a nonfriable form, thus representing a low risk to human health and the environment and posing no threat of release until building deactivation, decontamination, and decommissioning occurs.	Not applicable.	Not applicable.	Not applicable.		The agencies decided that this site would be more appropriately administered and remediated (if necessary) under the INL Asbestos Abatement Program rather than the Federal Facility Agreement and Consent Order. INL asbestos management is conducted in accordance with National Emission Standards for Hazardous Air Pollutants.	
CPP-66 Coal-fired steam-generation facility fly ash pit located southeast of INTEC.	Not available	Not available.	Site CPP-66 was evaluated using the Track 1 process and recommended for No Further Action based on a human health risk evaluation. The measured concentrations of radionuclides and inorganics in the fly ash are sufficiently low as to pose a negligible risk under both residential and occupational scenarios. The low permeability of the dried ash and low rainfall at the INL provide little driving force for leaching of ash constituents to the groundwater. Subsequently, an ecological risk screening was performed during the	Not available.	Not available.	Not available.	Poses solely an ecological risk.	The agencies have determined that the site will be transferred to OU 10-04 for further evaluation and remediation, if necessary.	

Table 4-6. (continued).

Site Number	COC	Final Remediation Goal and Basis	Residual Concentration (mg/kg or pCi/g)	Current Occupational Risk	Future Occupational Risk (30 years)	Future Residential Risk (100 years)	Ecological Risk (hazard quotient)	Remediation Status	Basis for ICs and Comments
			OU 3-13 RI/BRA, which suggested that a risk to environmental receptors may exist from the metals present in the ash.						
CPP-65 This site includes four sewage treatment plant lagoons. The lagoons are contaminated with low levels of radioactivity. The liners currently leak, and it is estimated that large volumes of liquids may have been released.	Not applicable	Not applicable.	The sewage treatment plant does not contain COCs in concentrations that present a threat to human health and the environment either through surface exposure or through transport to the Snake River Plain Aquifer.	Significant source of water but insignificant source of contamination. This site is included in the groundwater model.	Significant source of water but insignificant source of contamination. This site is included in the groundwater model.	Significant source of water but insignificant source of contamination. This site is included in the groundwater model.		The agencies have decided that final closure of the sewage treatment plant lagoons will be most appropriately handled under the Idaho Waste Water Land Application Rules (IDAPA 58.01.02); this decision was based on the low concentration of contaminants observed in lagoon water and the continued use of lagoons.	

COC = contaminant of concern
CPP = Chemical Processing Plant
HI = hazard index
IC = institutional control
ICDF = INL CERCLA Disposal Facility
INL = Idaho National Laboratory
INTEC = Idaho Nuclear Technology and Engineering Center
MCL = maximum contaminant level
OU = operable unit
PEW = process equipment waste
ppm = parts per million

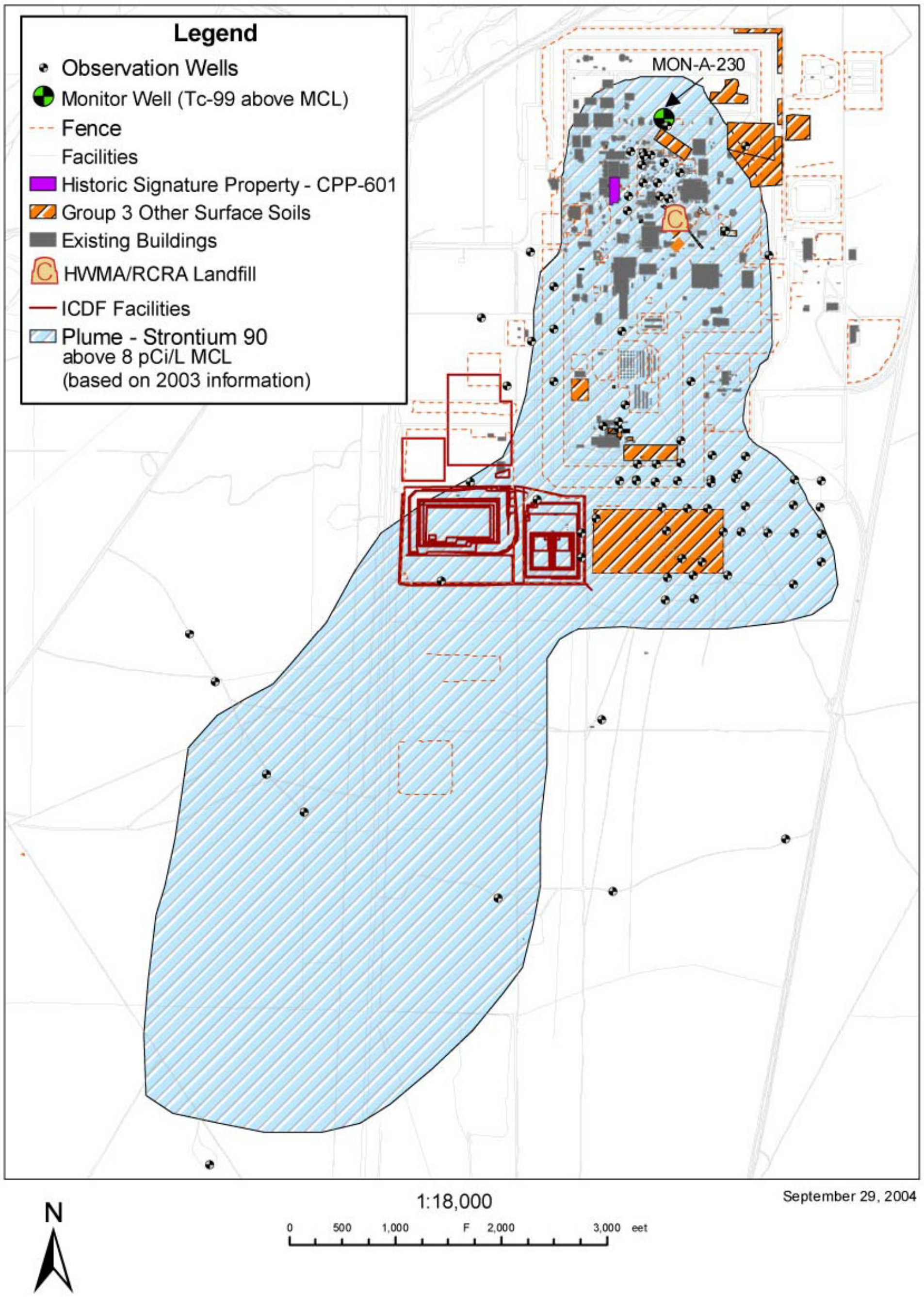

Figure 4-23. Idaho Nuclear Technology and Engineering Center map—current state.

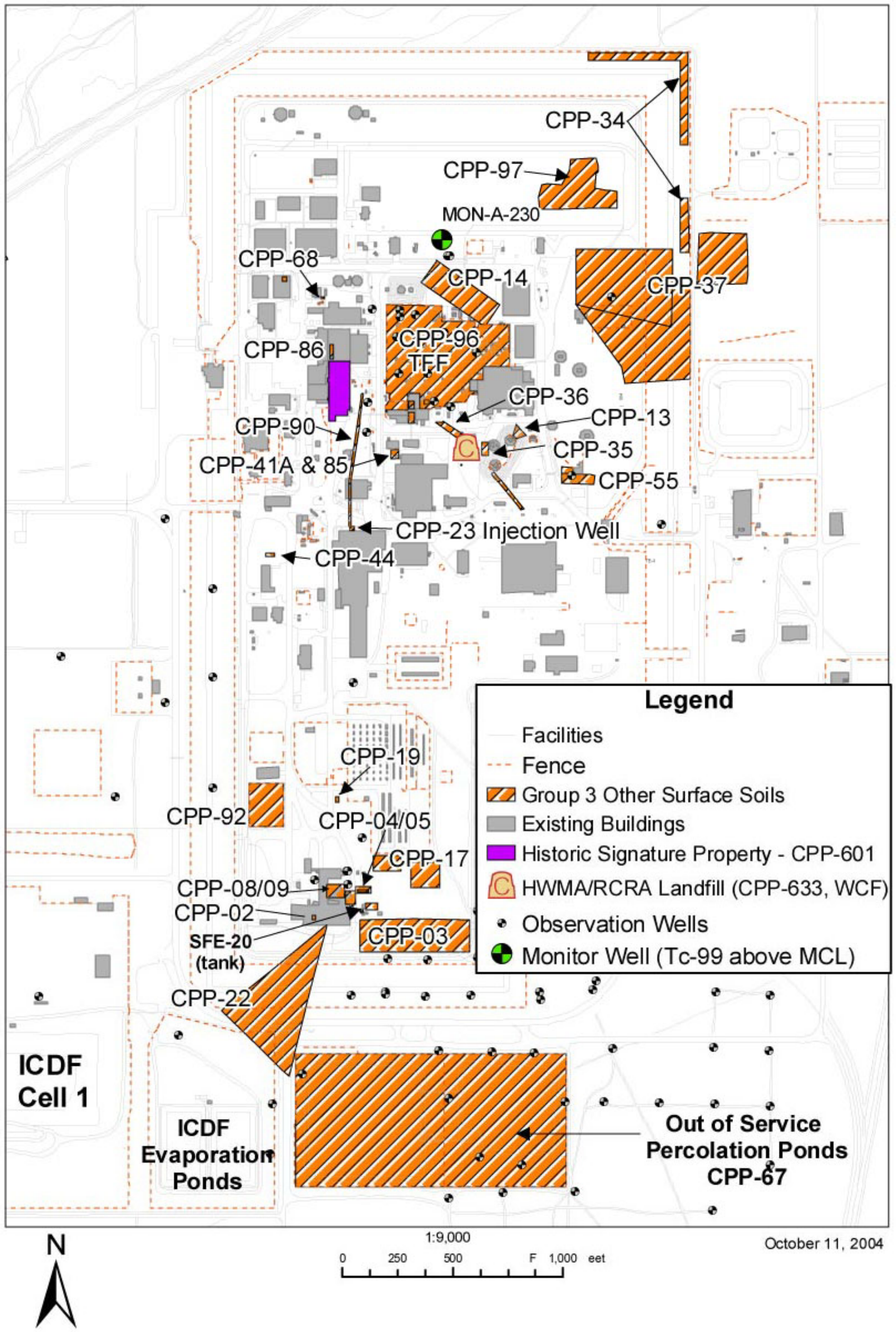

Figure 4-24. Idaho Nuclear Technology and Engineering Center facility detail map—current state.

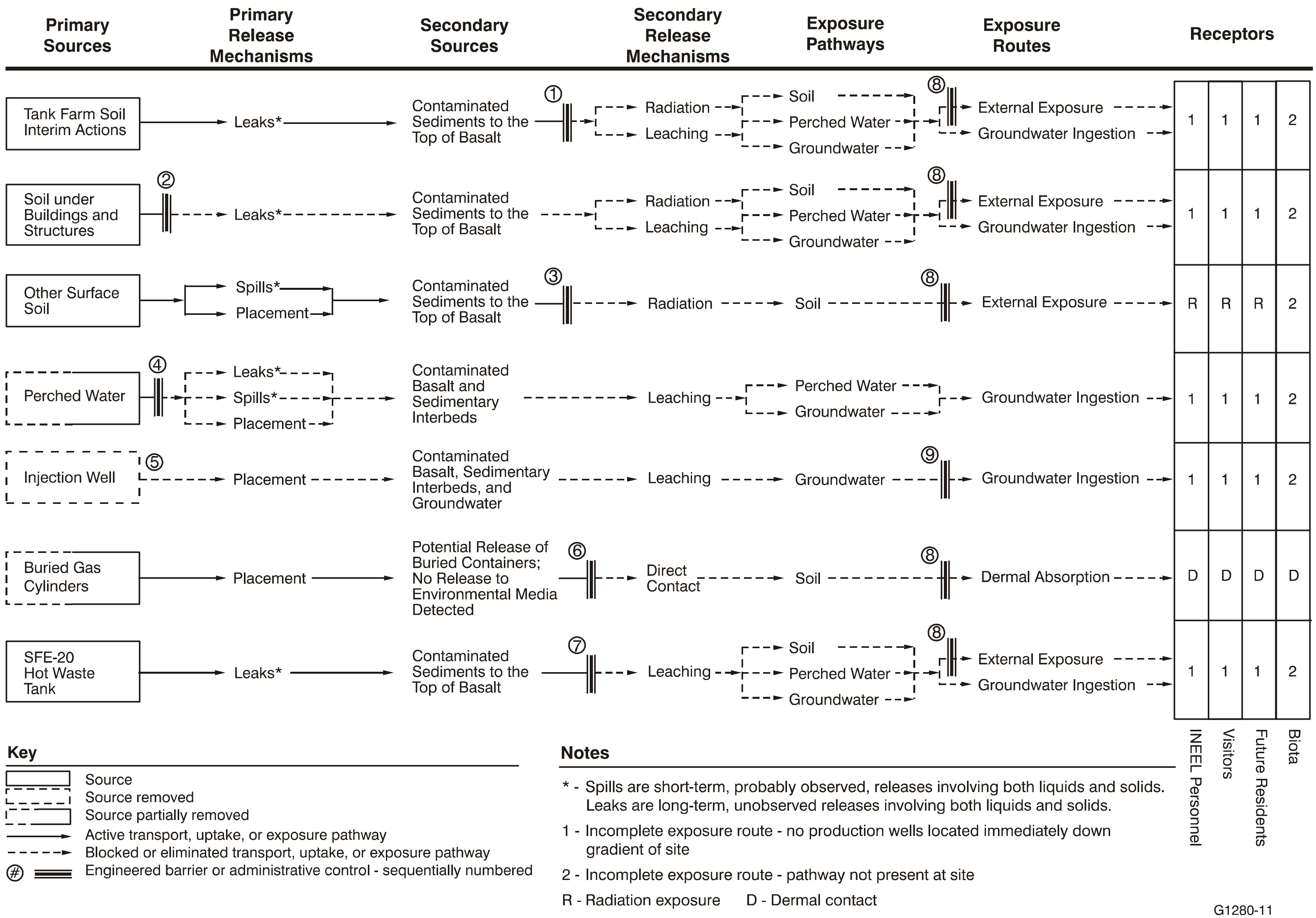

Figure 4-25. Idaho Nuclear Technology and Engineering Center conceptual site model—current state.

Narrative for Figure 4-25 Idaho Nuclear Technology and Engineering Center Conceptual Site Model—Current State

The remediation field activities performed to date for OU 3-13 are:

- Tank Farm Soil Interim Actions. The majority of the tank farm soil interim actions have been completed. These activities include construction of an evaporation pond, surface sealing outside of the tank farm fence, and constructing and upgrading the INTEC storm water collection system, including grading and lining ditches with concrete, installing new culverts, and installing a new storm water lift station. The remaining interim action activity is to pave hot spots inside the tank farm fence, which is planned for completion in Fiscal Year 2004.

- Soil under Buildings and Structures. No remediation field activities have been performed. A building drainage evaluation was performed for these sites, resulting in no significant changes required for protection.

- Other Surface Soil. No field remediation activities have been performed to date.

- Perched Water. Twenty-one new wells were drilled in and around INTEC in Fiscal Year 2000. A tracer study was conducted at the INTEC percolation ponds and sewage lagoons in Fiscal Year 2001 and 2002. The INTEC percolation ponds were relocated 2 miles southwest of INTEC. The new ponds were put into use in August 2002. In addition, annual perched water sampling has been conducted for the past 3 years.

- Snake River Plain Aquifer. Four borings into the aquifer were drilled in Fiscal Year 2002, and annual groundwater sampling has been performed.

- Buried Gas Cylinders. The hydrogen fluoride cylinders at Site 94 have been removed and disposed of. Remediation of Sites 84 and 94 is in progress, planned for completion in Fiscal Year 2004.

- SFE-20 Hot Waste Tank. No field remediation activities have been performed to date.

<u>Actions and Barriers</u>:

The steps taken to mitigate or remove these hazards are as follows:

1. The tank farm tanks are equipped with a leak-detection system. Access to the tank farm has been restricted by way of institutional controls to control exposure to workers and prevent exposure to the public. Implementation of surface water controls is under way to minimize infiltration through potentially contaminated soil. Measures to minimize this infiltration include: (1) diverting storm water away from contaminated soil with diversion channels designed and built to accommodate and route the 25-year, 24-hour storm event, (2) grading and surface sealing the tank farm soil, and (3) improving exterior building drainage to direct water away from contaminated areas. The tank farm soil release sites will be remediated under the OU 3-14 ROD scheduled to be submitted to DOE and the agencies in 2010.

2. Soil under Buildings and Structures consists of nine release sites that require institutional controls as part of the selected remedy mandated in the ROD. Until buildings and structures above the sites are closed and DD&D occurs, it is assumed that the building or structure will limit infiltration of water through the contaminated soil and prevent direct exposure to contaminated soil. Institutional controls, such as site access restrictions and periodic inspections of buildings and structures, are used to limit infiltration and prevent human exposure to contaminated soil. Currently, buildings CPP-601, CPP-627, and CPP-640 are in the deactivation planning phase. There are also a number of VCO closures in these facilities. Institutional control signs are posted at these buildings.

3. Other Surface Soil consists of 26 release sites that require institutional controls as part of the selected remedy mandated in the ROD. Unescorted access to INTEC by the general public is prohibited, and control of activities includes but is not limited to public notices, radiological work permits or general work orders, personnel training, and the soil disturbance notification process. Additional information on the nature and extent of contamination at each of the sites is available in *Operable Unit 3-13, Group 3, Other Surface Soils Remediation Sets 1-3 (Phase 1) Remedial Design/Remedial Action Work Plan* (DOE-ID 2004h).

4. A step toward controlling recharge beneath INTEC has been achieved by taking the original INTEC percolation ponds out of service and routing newly generated, uncontaminated service waste to new percolation ponds outside of the INTEC perched water area. Institutional controls are implemented to limit water use while INTEC operations continue and to prevent future drilling of potable water wells inside INTEC. These controls will help minimize migration of contaminants to the Snake River Plain Aquifer, so that the Snake River Plain Aquifer groundwater outside of the current INTEC security fence will meet the applicable State of Idaho groundwater standards by 2095.

5. The CPP-23 injection well was permanently closed by grouting in 1989.

6. The Buried Gas Cylinders consist of two gas cylinder sites that require institutional controls as part of the selected remedy mandated by the ROD. The cylinders at CPP-94 were removed, treated, and disposed of in 2001. The cylinders at CPP-84 will be removed in 2004 and remediation completed at both sites. Institutional controls consist of limiting access to only authorized personnel and visible access restrictions, including warning signs, the work control process, and copies of surveyed maps.

7. The SFE-20 Hot Waste Tank System site has institutional controls in place to prevent intrusion into the underlying tank systems, except for approved activities pursuant to the FFA/CO. Access is limited to only authorized personnel or DOE-certified radiation workers. Activities such as drilling or excavating are controlled, and the site has visible access restrictions (e.g., warning signs, the work control process, and copies of surveyed maps).

8. The entire INL Site has restricted access to prevent public access. The area within the INTEC fence line is a controlled area. A controlled area is an area to which access is managed by or for DOE to protect individuals from exposure to radiation or radioactive material (10 CFR 835.2). Pedestrian access and vehicular access to INTEC is controlled at two separate, manned barricades. Workers or visitors may access INTEC with a current INL badge, INL Site Access Training, INL Environmental Safety and Health and Quality Assurance Training, and, as required under "Occupational Radiation Protection" (10 CFR 835), General Employee Radiological Training or Radiological Worker I or II Training. Unescorted access to INTEC by the general public is prohibited.

9. Institutional controls are currently in place, and groundwater monitoring is being performed to ensure that the remedial action objectives for the aquifer are met by 2095, as required. Concentrations are declining for all of the groundwater COCs identified in the OU 3-13 ROD (DOE-ID 1999b). Although not previously identified as a groundwater COC, the occurrence of technetium-99 in the aquifer is currently being investigated to determine concentration trends. Concentrations of technetium-99 above the MCL were discovered in MON-A-230 during the latter part of Fiscal Year 2003. Institutional controls are in place to prevent potable water use of the contaminated groundwater while INTEC operations continue and to prevent future drilling of wells near potential sources of contamination. These controls prevent onsite workers and nonworkers from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations. Drinking water from wells is routinely monitored at the INL.

Failure Analysis:

Although failed controls are most likely to be found during the annual assessments, they may be discovered at any time. Subcontractors identifying a failed control will notify DOE Idaho. DOE Idaho will notify the EPA and DEQ within 2 business days after discovery of any major activity inconsistent with the specific institutional controls for a site (e.g., unauthorized well drilling or intrusion into engineered covers) or of any change in the land use or land-use designation of a site addressed in the ROD and listed in the INL CFLUP (DOE-ID 1997a) (e.g., change in land use from industrial to residential). Minor inconsistencies (e.g., signs down or missing) will be resolved as necessary. If minor inconsistencies are identified during the annual assessment, the issue and resolution will be documented in the reports.

If DOE Idaho believes that an emergency exists, DOE Idaho can respond to the emergency immediately before notifying EPA and DEQ and need not wait for any EPA or DEQ input to determine a plan of action. DOE Idaho will identify the root cause of the institutional control process failure, evaluate how to correct the process to avoid future problems, and implement these changes after consulting with EPA and DEQ. Table A-1 (see Appendix A) provides responses to failed control procedures that will be used during DOE Idaho control of the INL Site.

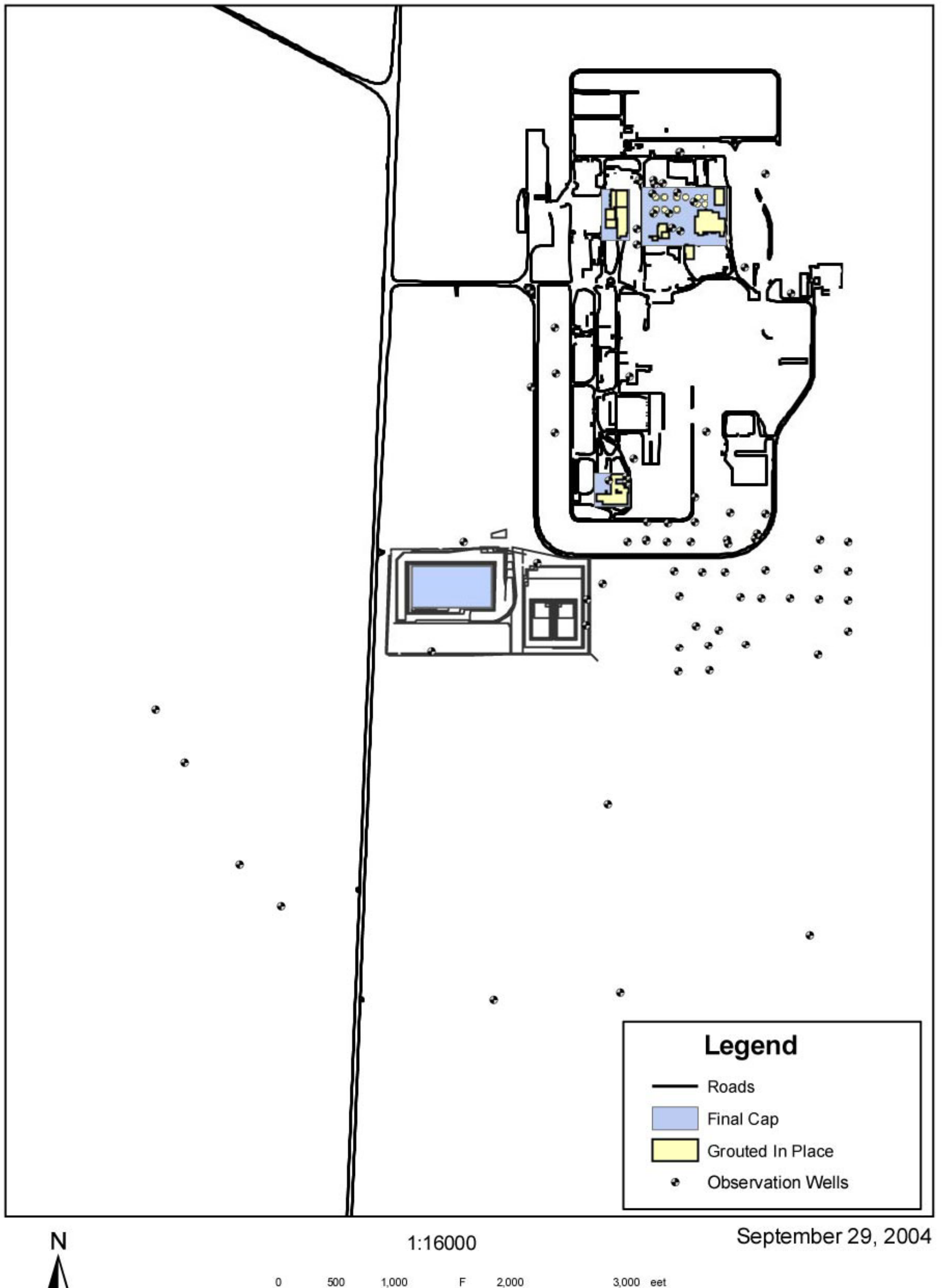

Figure 4-26. Idaho Nuclear Technology and Engineering Center map—end state.

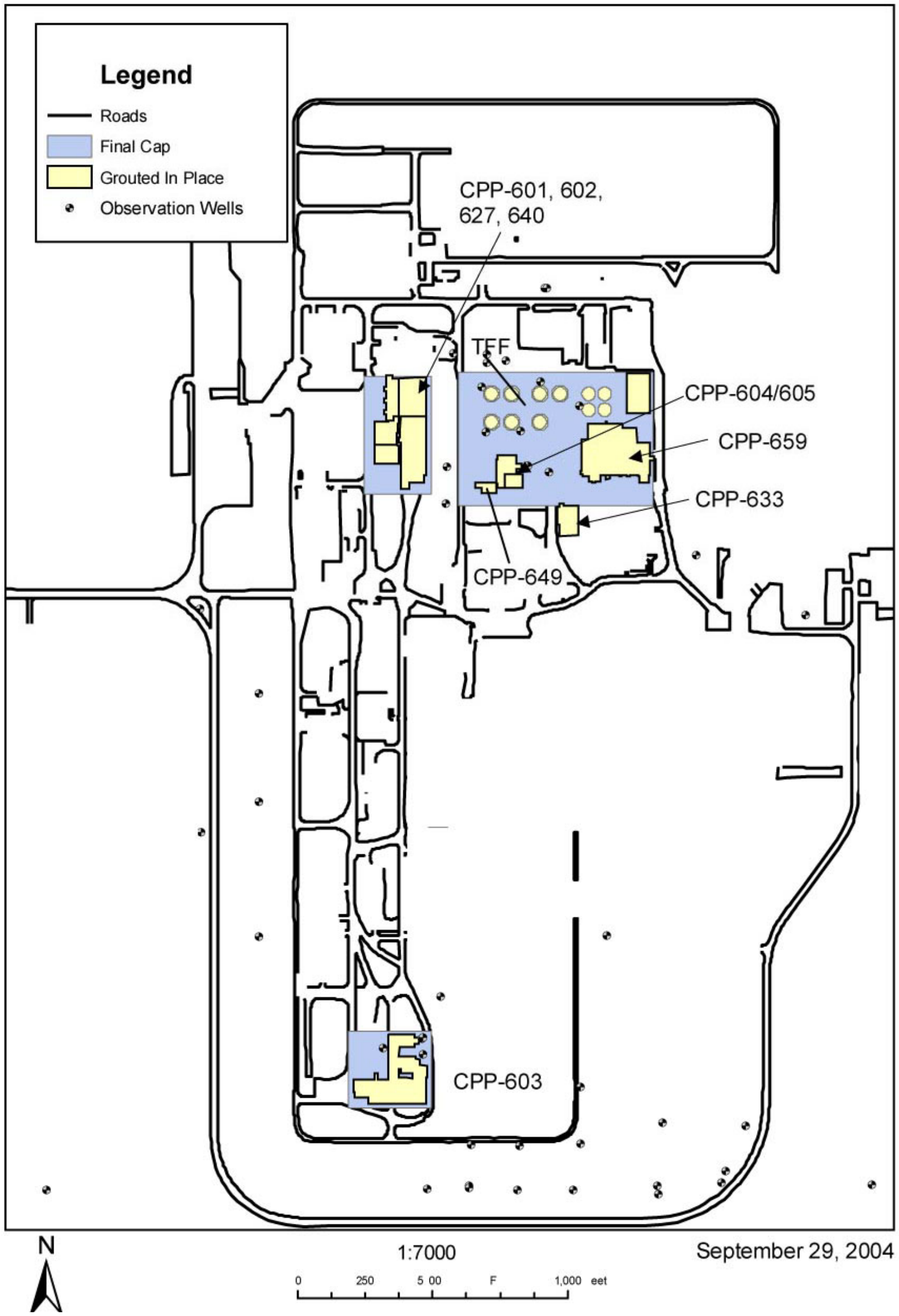

Figure 4-27. Idaho Nuclear Technology and Engineering Center facility detail map—end state.

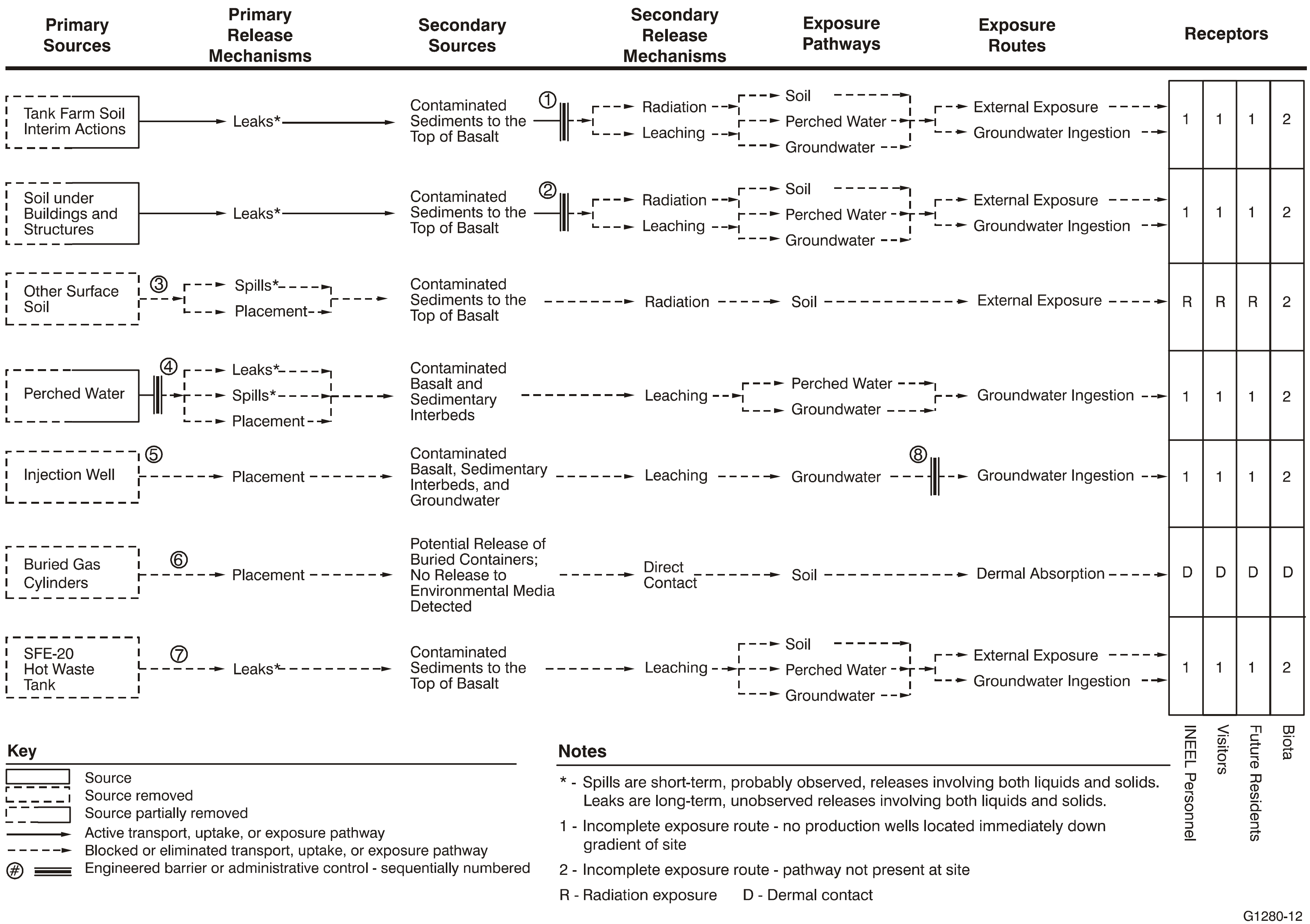

Figure 4-28. Idaho Nuclear Technology and Engineering Center conceptual site model—end state.

Narrative for Figure 4-28 Idaho Nuclear Technology and Engineering Center Conceptual Site Model—End State

The INTEC 2035 end state will require completion of FFA/CO specified actions, VCO closures, RCRA closures, and INTEC-specific strategic initiatives as spelled out in the *Performance Management Plan* (DOE-ID 2002b).

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. Tank Farm Soil Interim Actions include restricting access to control exposure to the public from soil at the tank farm; accommodating a one-in-25-year, 24-hour storm event with surface water run-on diversion channels; minimizing precipitation infiltration by grading and surface-sealing tank farm soil located at selected areas sufficient to divert 80% of the average annual precipitation on these areas; and improving drainage systems surrounding the tank farm to direct water away from contaminated areas. The tank farm soil release sites will be remediated under the OU 3-14 ROD scheduled to be submitted to DOE and the agencies in 2010.

2. Upon completion of DD&D, those sites will be capped in place, or contaminated soil will be excavated and disposed of at the ICDF.

3. The selected remedial action, which includes removing contaminated soil and debris above the 1-in-10,000 risk level, was based on an assumption of potential residential use in 2095 and beyond. Contaminated soil will be replaced with clean soil, so that the land can be used without incurring occupational exposures to radionuclides. Contaminated soil and debris will be disposed of at the newly constructed ICDF. To prevent inadvertent occupational exposure to residual radionuclides remaining at the release sites following remediation, the sites will be surveyed, and contamination left in place will be recorded for institutional control purposes.

4. Institutional controls are in place to prevent use of perched water and future drilling of potable water wells into or through the perched zone. Some of the major sources of recharge will have been eliminated (e.g., percolation ponds).

5. The CPP-23 injection well was permanently closed by grouting in 1989.

6. CPP-84 and CPP-94 will be remediated to remove the source of contamination in 2004, and it is anticipated that institutional controls will not be required after remediation.

7. The selected, risk-based remedial alternative for the SFE-20 Hot Waste Tank System is removal, treatment, and disposal. This alternative includes removal and onsite treatment of the tank contents, off-Site disposal of the tank and its contents, and land disposal of the vault and other debris at the ICDF. Any contaminated soil that may exist beneath the structure exceeding risk-based levels will be excavated and disposed of in the ICDF. Since the SFE-20 system contains mixed waste, RCRA closure of the SFE-20 tank system also will be required.

8. Implementation of institutional controls and groundwater monitoring will continue to ensure that the remedial action objectives for the aquifer are met by 2095, as required. Institutional controls will prevent future drilling of potable water wells near potential sources of contamination. These controls will help prevent onsite workers and nonworkers during the institutional control period from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations. Drinking water from wells is routinely monitored at the INL. Five-year reviews will be conducted as required under CERCLA to assess the effectiveness of the selected remedial alternative. In the event that the DOE mission should end at some unknown time in the future, deed restrictions would be required to prevent intrusion into those areas with residual contamination.

Failure Analysis:

Although failed controls are most likely to be found during the annual assessments, they may be discovered at any time. Subcontractors identifying a failed control will notify DOE Idaho. DOE Idaho will notify the EPA and DEQ within 2 business days after discovery of any major activity inconsistent with the specific institutional controls for a site (e.g., unauthorized well drilling or intrusion into engineered covers) or of any change in the land use or land-use designation of a site addressed in the ROD and listed in the INL CFLUP (DOE-ID 1997a) (e.g., change in land use from industrial to residential). Minor inconsistencies (e.g., signs down or missing) will be resolved as necessary. If minor inconsistencies are identified during the annual assessment, the issue and resolution will be documented in the reports.

If DOE Idaho believes that an emergency exists, DOE Idaho can respond to the emergency immediately before notifying EPA and DEQ and need not wait for any EPA or DEQ input to determine a plan of action. DOE Idaho will identify the root cause of the institutional control process failure, evaluate how to correct the process to avoid future problems, and implement these changes after consulting with EPA and DEQ. Table A-1 (see Appendix A) provides responses to failed control procedures that will be used during DOE Idaho control of the INL Site.

4.5 Radioactive Waste Management Complex

The Radioactive Waste Management Complex (RWMC) is located in the southwestern corner of the INL (see Figure 4-29). The facility encompasses a total of 177 acres and is divided into three separate areas by function: the Subsurface Disposal Area (SDA), the Transuranic Storage Area (TSA), and the administration and operations area. The mission of the facility from 1952 to 1970 was to manage disposal of radioactive waste. Since 1970, the mission has been to dispose of LLW and to store, treat, and prepare stored transuranic waste for off-Site shipment and disposal.

Figure 4-29. Aerial view of the Radioactive Waste Management Complex.

The RWMC facility is located in a natural topographic depression surrounded by basaltic and lava ridges. The ground surface is relatively flat, and the elevation is about 5,000 ft above sea level. The regional subsurface consists mostly of layered basalt flows with a few comparatively thin layers of sedimentary deposits. These sedimentary deposits, called interbeds, tend to slow infiltration to the aquifer. The Snake River Plain Aquifer lies beneath the facility at a depth of about 580 ft. The active portion of the aquifer is about 250 ft thick, and the bottom of the aquifer is 1,200–1,500 ft below ground. The local direction of aquifer flow is generally to the south-southwest. Aquifer flow velocity varies from 5 to 20 ft/day. Perched water zones have been encountered at depths of 80–100 ft and 180–230 ft beneath the SDA. These zones are believed to be recharged by precipitation. At present, very little water is contained in the perched water zones.

The SDA, comprising the western two-thirds of RWMC, is a disposal facility for radioactive waste. The original facility, established in 1952, covered 13 acres in the western portion of the SDA and was called the Nuclear Reactor Testing Station Burial Ground. The SDA currently is 97 acres in size, with approximately 35.5 acres used for waste disposal and 61.5 acres comprising berms, utilities, access areas, monitoring points, and unused space. Areas used for waste disposal comprise 21 pits, 58 trenches, 21 soil vault rows, and an abovegrade asphalt pad (Pad A). From 1954 through 1970, 67,460 m^3 of transuranic waste, mostly from the Rocky Flats Plant in Colorado, were disposed of at the SDA. Land disposal of transuranic waste was discontinued in 1970, and land disposal of mixed waste was discontinued by 1983. A portion of the SDA, Pits 17–20, is active and used for LLW disposal from operations on the INL Site.

The TSA was added to the east side of the SDA in 1970 and encompasses 58 acres. The TSA was first used to segregate and retrievably store waste with transuranic radionuclides, and this retrievable waste storage has been maintained since 1970. Waste stored in the TSA is being retrieved, prepared for transfer, and shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico. Presently, the TSA stores approximately 62,000 m^3 of transuranic waste in buildings and on covered, aboveground storage pads.

The 22-acre administration and operations area at RWMC includes administrative offices, maintenance buildings, equipment storage, and miscellaneous support facilities. These facilities support SDA and the TSA operations and maintenance at RWMC.

Waste acceptance criteria and recordkeeping protocols for the SDA have changed over time in keeping with waste management technology and legal requirements. Today's requirements are much more stringent as a result of knowledge gained over the past several decades about potential environmental impacts of waste management techniques. In the past, however, shallow landfill disposal of radioactive and hazardous waste was the technology of choice.

From 1952 to 1959, routine solid waste, typically consisting of paper, laboratory glassware, filters, metal pipe fittings, and other items contaminated by mixed fission products, was packaged in cardboard boxes. Boxes were taped shut and collected in dumpsters that were eventually emptied into trenches excavated to basalt. Nonroutine solid waste, defined as waste that could cause excess personnel exposure, was placed either in wooden boxes or in garbage cans before disposal. Before 1957, the radiation level was not limited for any disposal, and items registering up to 12,000 R/hour were buried. Both nonroutine and routine solid waste was covered with soil. Because completion of a disposal documentation form was not a requirement until 1959, early disposal records are sketchy. During this period, the SDA also accepted waste shipments for permanent disposal from Rocky Flats Plant under the authorization of the Atomic Energy Commission. From 1954 to 1957, the Rocky Flats Plant transuranic-contaminated waste, packaged in drums or wooden crates, was stacked horizontally in pits and trenches together with the INL-generated mixed fission product waste. Records for Rocky Flats Plant disposals did not accompany those shipments. Instead, an annual summary of disposals provided total radionuclide content and waste volume.

In late 1959, the Atomic Energy Commission determined that land disposal was preferable to offshore ocean disposal of solid radioactive waste. The SDA was one of two facilities selected for interim disposal of these materials until a commercially operated land-disposal site could be established. From 1960 to 1963, the SDA accepted approved shipments from offsite generators.

During the early 1960s, standard practices for disposal operations were refined and formalized, and a recordkeeping system was implemented. Beginning in November 1963 and continuing until 1969, drums from Rocky Flats Plant were dumped into pits rather than stacked to reduce labor costs and personnel exposures. Environmental monitoring systems were improved by placing film badges around the perimeter of the facility. By the mid-1960s, concern about environmental impacts of waste disposal significantly influenced waste management practices. Modifications to waste management practices included increasing the minimum trench depth, lining the bottoms of excavations with at least 2 ft of soil underburden, compacting waste by dropping a heavy steel plate on the waste dumped in trenches, and increasing the soil cover over each disposal area to a minimum of 2–3 ft.

Hazardous waste was disposed of at the SDA until 1983. Common constituents of this hazardous waste were metals, such as lead; organic chemicals, such as carbon tetrachloride; and acids, depleted uranium, and caustics. From 1966 to 1970, an estimated 90,000 containers of organic chemicals were disposed of at the SDA. Major components of the organic chemicals include 24,000 gal of carbon tetrachloride; 25,000 gal of TCE, PCE, and 1,1,1,-trichloroethane; and 39,000 gal of Texaco Regal Oil (a lathe coolant).

In 1970, burial of waste classified as transuranic was discontinued. Since 1970, solid transuranic waste received at the RWMC has been segregated from nontransuranic solid waste and placed in interim storage at the TSA. LLW at the RWMC contaminated with transuranic isotopes less than or equal to 100 nCi/g but greater than 10 nCi/g also was excluded from disposal in the SDA and placed in interim storage at TSA. LLW contaminated with transuranic isotopes less than or equal to 10 nCi/g was disposed of in the SDA. Other modifications to SDA disposal practices, including compaction, changes to packaging criteria, and enlarging pit volumes, were made between 1970 and 1985. The film badges around the perimeter of the SDA were replaced with thermoluminescent dosimeters. Water samples also were collected and analyzed from subsurface monitoring holes, and field investigations were conducted to assess leaching. Beginning in 1980, explosive fracturing was used to deepen pit excavations. A soil layer at least 2 ft thick was added to cover basalt before waste was placed in the pit, and a final layer of compacted soil at least 3 ft thick was used to cover buried waste.

Disposal practices also were modified to minimize personnel exposures to radiation. Beginning in 1977, areas not suited for pits were reserved for soil vaults. Drilled in rows, soil vaults were unlined, cylindrical, vertical holes with diameters ranging from 1.3 to 6.5 ft and averaging about 12 ft deep. Soil vaults were designed for disposing of remote-handled, high-radiation waste that was defined as material producing a beta-gamma exposure rate greater than 500 mR/hour at a distance of 3 ft. Soil vault disposals were conducted concurrently with trench disposals from 1977 to 1981. Trenches also received high-radiation waste until trench disposal was discontinued in 1981. General disposal practices were the same for pits and trenches. Compacted waste was bailed, larger bulky items were wrapped in plastic, and smaller noncompactable waste was contained in wooden boxes covered with fire-retardant paint. Waste was placed into the excavations by free-air transfer or in shielded casks, depending on the exposure rate measured on the outside of the waste container. As each excavation became full, the disposal area was covered with a final compacted soil layer at least 3 ft thick.

Risk assessment information is published in the *Ancillary Basis for Risk Analysis of the Subsurface Disposal Area* (hereinafter referred to as the Ancillary Basis for Risk Analysis) (Holdren et al. 2002). The purpose of this document is to provide the DOE, DEQ, and EPA with a basis for defining scope to complete the OU 7-13/14 comprehensive RI/FS. Information in the RI/FS will support future risk management decisions for WAG 7 under the FFA/CO. The following three RODs have been signed for RWMC:

- *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1993)—This ROD addresses interim action in Pit 9 at the RWMC SDA. The specified interim action is to retrieve transuranic and other waste buried in the pit. The *Agreement to Resolve Disputes, the State of Idaho, United States Environmental Protection Agency, United States Department of Energy* (DOE 2002c) established specific requirements for retrieval of waste and completion of the OU 7-13/14 ROD.

- *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area* (DOE-ID 1994a)—This ROD addresses organic contamination in the vadose zone beneath RWMC. VOCs have migrated from organic waste buried in the SDA. The remedy provides for vapor vacuum extraction and treatment of organic vapors.

- *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1994b)—This ROD includes remedial actions to enhance, recontour, maintain, and monitor the soil and rock cover at Pad A and establishes long-term institutional controls at the site.

The comprehensive ROD for the entire RWMC, including the buried waste area, is currently scheduled to be issued in 2008.

4.5.1 Current State

Maps showing the current state of RWMC are provided in Figures 4-30 and 4-31. The current mission of the facility is to safely and compliantly manage the disposal of low-level radioactive waste and the management of transuranic waste. Recent construction of the Advanced Mixed Waste Treatment Project expanded the RWMC's waste management operations to include treating and preparing the 62,000 m^3 of stored transuranic waste for shipment out of Idaho.

Several thousand cubic meters of low-level radioactive waste are disposed of at the SDA each year. Under the *Performance Management Plan* (DOE-ID 2002b), the goal is to continue disposal of contact-handled LLW through 2008 and to continue disposal of remote-handled LLW through 2009.

Waste is received at the RWMC for storage, examination, or disposal. Documentation accompanying each waste shipment is reviewed on arrival, and the shipment is visually examined for discrepancies and damage. Radiological surveys are conducted to ensure that radiation and contamination readings meet requirements. Requirements are specified in the RWMC waste acceptance criteria. If any abnormalities are discovered either in waste or documentation, they are resolved with the waste generator before the waste is formally accepted. Once accepted, waste is transferred to the SDA or the TSA, as appropriate.

Pits 17–20 comprise a single, large excavated area currently used for disposal of LLW. The pits were blasted into basalt to a total depth of approximately 33 ft, and the exposed basalt was covered with 2 ft of soil and a thin layer of gravel. A contoured earthen berm surrounds Pits 17–20. Waste is stacked within pits using forklifts and cranes. Maximum stack height is limited to 24 ft. As areas of the pits become full, waste is typically covered with approximately 8 ft of fine-grained soil from onsite sources. The soil cover is spread and compacted with dozers and sloped for drainage.

Disposal of remote-handled waste in soil vaults was discontinued in 1993. Concrete vaults, for remote-handled LLW, were constructed in the southwest corner of Pit 20. Constructed of precast, reinforced concrete sections resting on an integral base plate, vaults are configured in honeycomb arrays. Each array is surrounded by soil for additional shielding and seismic stability. Void spaces between vaults in each array are filled with sand. Each vault is covered with a 4-ft-thick concrete plug. Seams between adjacent plug caps are sealed with acrylic caulk to inhibit moisture infiltration. In Pit 20, 200 concrete vaults have been constructed, and about one-third of them are full.

Numerous measures are currently in place to limit the potential for occupational and public exposures to waste disposed of in the SDA. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring also are conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and surface water run-off. Modeling studies and research have been and continue to be conducted to assess the potential for contaminant migration and to focus monitoring and other protective measures on likely routes of potential exposure.

Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA, security fences and access controls, and land-use controls that restrict public access to the INL Site.

The TSA, a 58-acre area located in the southern section of the facility, is dedicated to the temporary storage of contact-handled and remote-handled transuranic waste. Much of the transuranic waste in the TSA also is mixed waste and therefore regulated under RCRA. This area also includes the Advanced Mixed Waste Treatment Project and waste storage facilities.

The Advanced Mixed Waste Treatment Project began operations in 2004. The project's mission is to retrieve and treat about 62,000 m^3 of transuranic waste currently stored at the TSA. Facility operations will prepare the waste for shipment to New Mexico's Waste Isolation Pilot Plant in accordance with the *Settlement Agreement* (DOE 1995) between the State of Idaho, DOE, and U.S. Navy. All operations will be completed no later than December 2018, after which the facility will undergo RCRA closure and DD&D.

Site characterization activities include drilling wells for characterizing and monitoring purposes, sampling various aspects and features of the area, and characterizing waste. CERCLA remedial designs and actions performed to date include limited retrieval of waste from Pit 9 and treatment of volatile organic contamination in the vadose zone using vapor vacuum extraction technology. Long-term monitoring of the vadose zone and aquifer is being conducted to track trends in existing contamination and to provide information to assess contaminant release and migration.

The full extent of environmental contamination at RWMC is being investigated. Decisions to remediate the contamination will be based on regulatory requirements and risk to human health and the environment.

An extensive network of monitoring wells is used for the ongoing evaluation of nature and extent of contamination at the following depth intervals: (1) the waste zone; (2) the vadose zone outside of the waste zone from depth intervals of 0 to 35 ft, 35 to 140 ft, and 140 to 250 ft; and (3) the vadose zone and aquifer at depths greater than 250 ft. The locations of the monitoring wells are shown on Figures 4-30 and 4-31.

Some COCs have been detected at low concentrations in the vadose zone. Most vadose zone detections are in the 0- to 35-ft and 35- to 140-ft intervals (Olson et al. 2003). COCs detected in the vadose zone are carbon tetrachloride, nitrates, carbon-14, and uranium isotopes. Other contaminants, including americium-241, tritium, iodine-129, plutonium-238, plutonium-239/240, strontium-90, and technetium-99, also have been detected in the vadose zone. Technetium-99 is regularly detected in one set of vadose zone lysimeters at the west end of the SDA at concentrations around 10 times lower than the MCL. In addition, carbon tetrachloride is regularly detected in the vadose zone, though concentrations decrease significantly below major sedimentary interbeds at approximate depths of 140 ft and 250 ft. Because carbon tetrachloride migrates in the gaseous phase, it also has been detected hundreds of feet laterally away from buried waste but still within the boundaries of the INL (Holdren et al. 2002).

Carbon tetrachloride has been measured in the aquifer at levels slightly above the MCL (5 μg/L). In 2003, carbon tetrachloride above MCLs was measured in four wells at concentrations ranging from 5.1 to 8 μg/L. These four wells (M7S, A11A31, and M16S and the RWMC production well) are shown on Figure 4-30. Low concentrations of nitrate, carbon-14, and tritium, although well below MCLs, also have been detected in the aquifer near the SDA through quarterly monitoring. However, contaminants are not consistently present, and no trends are evident.

Laboratory and field studies indicate that plutonium strongly adheres to rock and soil types found at the INL. Traces of plutonium have been detected in the aquifer beneath the RWMC at concentrations and frequencies consistent with false positives. Concentrations have ranged from 0.02 to 0.05 pCi/L, compared to plutonium's drinking water standard of 5 pCi/L.

The monitoring network at RWMC has been greatly expanded since 1998 with 22 additional vadose zone lysimeters, four upgradient aquifer wells, an aquifer well inside the SDA, and more than 300 probes in the buried waste. The expanded network will continue to produce data for ongoing evaluation of source release into the vadose zone, contaminant migration through the vadose zone, and potential impacts to the aquifer beneath the SDA. Monitoring data also will support future remediation by providing a baseline for remediation goals. Vadose zone water and gas monitoring also are being initiated in ports that have been recently installed within the active LLW disposal pit.

A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction and treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. In the spring of 2004, two of the units were replaced with new vapor vacuum extraction units that can extract and treat three times the contaminants as the previous system. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal. To date, more than 173,000 lb of VOCs have been removed from the vadose zone through use of the vapor extraction system.

Two non-time-critical removal actions to reduce risk at the SDA are being executed in 2004. One of the actions involved grouting beryllium blocks in the SDA. More than 11,000 lb of irradiated beryllium were disposed of in the SDA. The action will reduce the release of carbon-14 from corrosion of the beryllium blocks. A waxlike grout substance was injected into the waste zone around the beryllium blocks to solidify and isolate the blocks. The second non-time-critical removal action involves retrieval of buried waste from a 1/2-acre area of Pit 4 at the SDA. This work will remove selected waste containing VOCs, which are the most mobile constituents in the buried waste and the most imminent threat to the aquifer. Waste forms containing isotopes of uranium, plutonium, and americium are also targeted. Taking this action now will remove some of the highest concentrations of transuranic contaminants in the SDA and reduce risk to the Snake River Plain Aquifer. Transuranic waste that is retrieved will be shipped to the Waste Isolation Pilot Plant in New Mexico for final disposal. Other material removed during the retrieval will be treated to remove the VOCs and disposed of properly.

Buried waste within the trenches, pits, and soil vault rows at the SDA poses a potential risk to human health by way of several pathways shown in the current state conceptual site model (see Figure 4-32). The current state conceptual site model considers hypothetical residential and occupational scenarios for the following exposure pathways: air inhalation, direct exposure, groundwater ingestion, food ingestion, soil ingestion, and crop ingestion (Holdren et al. 2002).

4.5.2 End State

Current plans call for disposal of LLW in the SDA to be discontinued by 2009. A federal task force was chartered to assess the viability of this plan as well as other alternatives for LLW disposal. The task force recommendations are being reviewed by DOE management to determine if a revision to the *Performance Management Plan* (DOE-ID 2002b) is warranted. Stored waste at the TSA will be retrieved and shipped off-Site by 2018. RWMC has not been identified to have a long-term NE mission. Therefore, it is anticipated that the buildings and infrastructure will be removed before 2035. No remediation will be required in the administration and operations areas beyond building demolition.

Under the FFA/CO, the final remedy for RWMC will be determined in the future. The enforceable schedule for OU 7-13/14 requires that DOE submit a draft remedial investigation/baseline risk assessment in August 2006, a draft feasibility study by December 2006, and a draft ROD by December 2007.

The feasibility study for the overall remediation of all buried waste in the RWMC will evaluate the full range of alternative remedial actions possible for the SDA and determine their comparative effectiveness, difficulty, cost, and other factors. As with any site with buried hazardous substances, the range of alternatives could include excavation and removal of all buried transuranic waste and disposal at another location; selective removal and redisposal elsewhere of some transuranic waste; immobilization of waste, such as through in situ grouting, to prevent movement in the environment to other soil, air, or groundwater; construction of a surface barrier to cap the waste burial areas in order to limit infiltration of rain and snowmelt through the waste and subsequent transport of contaminants into the aquifer; and various combinations of these approaches. Regardless of the selected remedy, some selective grouting of waste may be required. A fundamental assumption in the *Second Addendum to the Work Plan for the OU 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study* (Holdren and Broomfield 2004) is that all remedial alternatives for the SDA will include a cap as shown in the end state map in Figure 4-33. The cap design would be selected to effectively inhibit unacceptable ecological exposures and surface pathway exposures for human receptors. Long-term stewardship will be required at the RWMC to maintain the cap, monitor the site, and restrict access to residual contamination. These issues will be addressed in the ROD for OU 7-13/14.

The completed draft feasibility study will be submitted for DEQ and EPA comments no later than December 2006. The revised, final feasibility study will be the basis for drafting a proposed plan and draft ROD that will undergo revision based on DEQ and EPA comments. The final ROD will address public comments and provide legally binding remedial decisions for the RWMC.

Although the final remedy has not yet been determined, a conceptual site model that represents the anticipated end state is provided in Figure 4-34.

4.5.3 Risk Assessment Summary

Risk assessment information for the RWMC is included in the Ancillary Basis for Risk Analysis. Site evaluation is typically an iterative process, with each step providing an increasingly refined assessment. The Ancillary Basis for Risk Analysis (Holdren et al. 2002) was a continuation and update of the *Interim Risk Assessment and Contaminant Screening for the Waste Area Group 7 Remedial Investigation* (Becker et al. 1998) and *Review of Waste Area Group 7 Ecological Contaminants of Potential Concern* (Hampton and Becker 2000). The Ancillary Basis for Risk Analysis was prepared to support the future comprehensive RI/FS. Analysis focused on buried waste in the SDA. Because of ongoing operations at TSA, evaluating residual contamination has been deferred until future closure of the facility. TSA operations will be closed under RCRA, with any residual contamination to be addressed under CERCLA.

Modeling was conducted to simulate release and migration of contaminants from waste buried in the SDA and to estimate future contaminant concentrations in environmental media. It was assumed that nonradioactive contaminants do not degrade; however, half-lives of radionuclides were considered.

Sixteen human health COCs were identified in the Ancillary Basis for Risk Analysis, and one COC was added later (Holdren and Broomfield 2004). In addition, plutonium-238, plutonium-239, and plutonium-240 were classified as special-case COCs to acknowledge uncertainties about plutonium mobility in the environment and to reassure stakeholders that risk management decisions for the SDA will be fully protective. The ecological risk assessment identified seven COCs, five of which are also human health COCs. The conclusion of the report was that the SDA poses unacceptable long-term risk to human health and the environment.

4.5.3.1 Human Health Risk Assessment. Human health risk assessments include CERCLA risk assessment and "Radioactive Waste Management" (DOE O 435.1) risk assessment.

4.5.3.1.1 CERCLA Risk Assessment—Potential risks to human receptors posed by the 24 COPCs defined in the *Interim Risk Assessment and Contaminant Screening for the Waste Area Group 7 Remedial Investigation* (Becker et al. 1998) were quantitatively evaluated in the human health component of the Ancillary Basis for Risk Analysis. Analysis included exposure and toxicity assessments, risk characterization, and limited evaluation of sensitivity and uncertainty.

Risk estimates were developed for current and future occupational receptors and for current and hypothetical future residential receptors. For the current residential scenario, groundwater ingestion risk at the INL boundary was assessed. Surface exposure pathways were not examined for a current residential exposure because residential development near the RWMC is prohibited by site access restrictions. Future residential exposures were simulated to begin in 2110 to reflect remediation in 2010 followed by an assumed 100-year institutional control period. The future residential analysis reflects assumptions that a cap and institutional controls would preclude intrusion into the buried waste, that a home could be constructed immediately next to the RWMC, and that residential groundwater use would be unrestricted. Concentrations and risks to residential receptors were simulated out to 1,000 years for all pathways. Groundwater risks were simulated until peak concentrations occurred up to a maximum of 10,000 years.

Occupational exposure was evaluated through 2110 at the end of the simulated 100-year institutional control period. Occupational receptors were located on the SDA. Current monitoring and institutional controls preclude the drinking of contaminated groundwater during the occupational scenario. Therefore, occupational exposures are limited to soil ingestion, dermal contact with soil, inhalation of particulates and vapors, and exposure to ionizing radiation.

The following human health exposure routes were evaluated: soil ingestion, inhalation of fugitive dust, inhalation of volatiles, external radiation exposure, dermal adsorption of contaminants in soil (organic contaminants only), groundwater ingestion (residential scenario only), ingestion of homegrown produce (residential scenario only), and dermal adsorption of contaminants in groundwater (residential scenario only).

Thirteen radionuclides and four chemical contaminants are human health COCs (Holdren and Broomfield 2004): americium-241, carbon-14, chlorine-36, iodine-129, niobium-94, neptunium-237, strontium-90, technetium-99, uranium-233, uranium-234, uranium-235, uranium-236, uranium-238, carbon tetrachloride, methylene chloride, nitrates, and tetrachloroethylene. Carcinogenic risk estimates for the hypothetical future residential exposure scenario are greater than or equal to 1 in 100,000 for 15 contaminants, and three contaminants have an HI greater than or equal to 1. Three plutonium isotopes were classified as special-case COCs to acknowledge uncertainties about plutonium mobility in the environment and to reassure stakeholders that risk management decisions for the SDA will be fully protective. Table 4-7 provides additional information on risk associated with the COCs.

Carbon tetrachloride poses the most imminent risk. Carbon tetrachloride has been detected in the aquifer slightly above MCLs in four wells and is being extracted from the vadose zone to reduce risk. However, VOC release from waste buried in the SDA is ongoing and, if not sufficiently mitigated by the vadose zone vapor vacuum extraction, poses the most imminent risk. The Accelerated Retrieval Project for a Described Area within Pit 4 also will remove VOC-containing waste from the SDA to address the source of this contaminant in the Pit 4 area.

Mobile long-lived fission and activation products are the next most immediate concern. These include carbon-14, iodine-129, and technetium-99. Uranium and neptunium-237 contribute to the majority of the risk several hundred years in the future.

Risk estimates for hypothetical future residential exposure bounded risks for all scenarios by exceeding those both for occupational scenarios and for the current residential scenario. The location of the maximum cumulative risk is near the southeast corner of the SDA, and the primary exposure pathway is groundwater ingestion. A qualitative uncertainty analysis and limited sensitivity analysis are included in the Ancillary Basis for Risk Analysis (Holdren et al. 2002).

4.5.3.1.2 Radioactive Waste Management Risk Assessment—"Radioactive Waste Management" (DOE O 435.1) and "Radioactive Waste Management Manual" (DOE M 435.1-1) require that performance assessments and composite analyses be conducted before disposal authorizations are issued for LLW facilities. Performance assessments are conducted to evaluate the expected performance of the proposed LLW disposal facility operations and closure. The composite analysis is used to project cumulative impacts to hypothetical future members of the public from the LLW disposal facility and all other sources of radioactive contamination at the INL that could interact with the facility to affect the radiological dose. Results are compared to the DOE primary public dose limit of 100 mrem/year and the dose constraint of 30 mrem/year. An options analysis is required if the composite analysis indicates the public dose constraint of 30 mrem/year will be exceeded. The period for which the dose limit must not be exceeded is 1,000 years after closure of the facility. This period is referred to as the compliance period.

The disposal authorization for the SDA was conditionally issued in April 2000, and all conditions were successfully resolved in August 2003. Supporting documents include *Technical Revision of the Radioactive Waste Management Complex Low-Level Waste Radiological Performance Assessment for Calendar Year 2000* (Case et al. 2000), *Maintenance for the Radioactive Waste Management Complex Performance Assessment and Composite Analysis* (Shuman 2000), *Radioactive Waste Management Complex Low-Level Waste Radiological Composite Analysis* (McCarthy et al. 2000), *Performance Assessment and Composite Analysis Monitoring Program* (McCarthy, Seitz, and Ritter 2001), and *Annual Performance Assessment and Composite Analysis Review for the RWMC Low-Level Waste Disposal Facility – FY 2003* (Parsons and Seitz 2004). Both the performance assessment and composite analysis are currently being updated.

The composite analysis for the SDA at RWMC was completed in September 2000. Six radionuclides at RWMC were identified as the primary radiological risk drivers: carbon-14, chlorine-36, iodine-129, neptunium-237, uranium-234, and uranium-238. For the purposes of the analysis, it was conservatively assumed that the RWMC SDA would be closed without any removal of waste or stabilization through grouting and that the entire SDA would be covered with a surface barrier capable of matching the background infiltration rate (0.4 in./year). It was assumed that the barrier would be placed over the SDA in 2021 and that, because of the simple design, it would be effective in reducing infiltration to the background rate of 0.4 in./year in perpetuity. (Many other assumptions are listed in the composite analysis [McCarthy et al. 2000].)

Hypothetical residential receptors were located at the INL Site boundary until the year 2120 (i.e., during the 100-year institutional control period) and at 100 m (328 ft) from the RWMC boundary thereafter. The receptors were assumed to consume contaminated groundwater, leafy vegetables and produce that were irrigated with contaminated groundwater, and milk and meat from animals that consumed contaminated water and pasture grass irrigated with contaminated groundwater. Other pathways, such as inhalation of dust and direct radiation from soil, were considered to be negligible when compared to pathways such as direct ingestion of contaminated water.

Maximum doses to receptors were calculated for a 100-year institutional control period, a 1,000-year compliance period, and a 10,000-year simulation period. It was found that, during the 100-year institutional control period, the peak dose at the INL boundary would be negligible. The maximum dose was found to be 0.07 mrem in the year 2042. The largest predicted all-pathways dose is from carbon-14, with a maximum dose of 0.05 mrem/year in the year 2042.

During the compliance period (until year 3000), the maximum dose, 100 m (328 ft) downgradient of the SDA, would be 29 mrem/year in the year 2596. The largest predicted all-pathways dose is from carbon-14, with a maximum dose of 24.3 mrem/year in the year 2646.

During the total simulation period (until year 12,010), the maximum all-pathways dose, 100 m (328 ft) downgradient of the SDA, is predicted at 226 mrem/year in the year 12,010. The largest predicted all-pathways dose is from neptunium-237, with a maximum dose of 153 mrem/year in the year 12,010. Modeling showed that extending the distance between the RWMC and the well used by the public would provide more time for nuclide decay and dispersion in the groundwater. Extending the boundaries of the controlled area from 328 to 984 ft resulted in almost 80% reduction in the maximum all-pathways dose. Extending the boundaries to 1,968 ft provided a 90% dose reduction. For the simulation period, extending the boundary of the controlled area to 984 ft would reduce the dose to the receptor from 227 to 47 mrem/year. Extending the boundary to 1,968 ft would further reduce the dose to 17 mrem/year, and locating the receptor at the INL boundary would reduce the dose to 2.1 mrem/year. These evaluations demonstrated that potential future impacts to members of the public would not be significant beyond a short distance from the SDA (984–1,968 ft), even with the highly conservative assumptions of no retrieval or stabilization of the waste in the SDA.

During the institutional control period until year 2120, the predicted radionuclide concentrations and associated peak doses are all below the groundwater protection performance objectives. No radionuclide concentrations above MCLs are predicted in the aquifer. However, during the compliance period (till year 3000), the estimated direct ingestion dose from manmade beta gamma is 7.4 mrem/year or 185% of the 4-mrem/year MCL if no remediation is conducted other than placing a cover over the waste. During the total simulation period (until year 12,000), it is predicted that MCLs for gross alpha and uranium would be exceeded. The maximum predicted peak uranium concentration is 745 μg/L, as compared to the MCL of 20 μg/L, in the year 10,000. In addition, the direct ingestion dose from manmade beta gamma is predicted to be 185% of the 4-mrem/year MCL.

Because the all-pathways dose to the public was predicted to be 29 mrem/year within the 1,000-year compliance period, the LLW Disposal Facility Federal Review Group requested an options analysis be conducted. The *Options Analysis for the Radioactive Waste Management Complex Composite Analysis* (Seitz 2002) focused on carbon-14, since carbon-14 accounted for more than 75% of the projected all-pathways dose. The composite analysis assumed that all of the carbon-14 would migrate downward to the groundwater. This report describes a column experiment that was conducted to determine the fraction of carbon-14 that migrates upward in the vapor phase versus the fraction that migrates downward. Results from this experiment received after publication of the Options Analysis confirmed that the majority of carbon-14 migrates upward, so the impact to groundwater and the all-pathways dose would be significantly lower than predicted in the composite analysis.

4.5.3.2 Ecological Risk Assessment. The WAG 7 ecological risk assessment was based on the assumption that most ecological risk will be addressed by actions implemented to reduce risks to human health and that the SDA will be capped. A biological barrier will impede intrusion into buried waste by plants and burrowing animals, thus controlling subsurface to surface movement for most contaminants. Emphasis of the assessment was on identifying pathways and exposure routes that must be controlled rather than on quantifying effects on specific species.

The flora and fauna at the RWMC are representative of the species found across the INL. Sagebrush-steppe on lava communities with dominant sagebrush-rabbitbrush vegetation makes up nearly 90% of the natural cover at RWMC. Most of the waste disposal areas within the SDA have been seeded with grass and are kept mowed. Larger mammals, such as coyotes and antelope, are generally excluded from the SDA and other facility structures by fences but are occasionally seen on facility grounds. Burrowing rodents, such as ground squirrels, voles, and mice, and insects, such as the harvester ant, are common RWMC inhabitants. The Townsend's ground squirrel, Ord's kangaroo rat, montane vole, and deer mouse are the most commonly occurring small mammals in the WAG 7 assessment area. Federally listed species of concern with a potential for occurring in the vicinity of WAG 7 include the ferruginous hawk, peregrine falcon, loggerhead shrike, burrowing owl, bald eagle, pygmy rabbit, Townsend's western big-eared bat, long-eared myotis, small-footed myotis, and sagebrush lizard. The RWMC does not encompass ecologically sensitive areas or areas of critical habitat.

The only surface water present at WAG 7 is temporary accumulation from rain and snowmelt. Consequently, sensitive aquatic species were not included in this assessment.

Current and 100-year scenarios were evaluated for representative receptors. Only exposure routes for the subsurface pathway were addressed in the assessment. The surface soil pathway was eliminated through screening, and no surface water features or pathways to groundwater exist for ecological receptors at the SDA. Contaminants in subsurface soil can be transported to ecological receptors by plant uptake with subsequent ingestion by herbivorous animals, and by burrowing animals. Animals receiving direct exposure are potential sources of indirect exposure when preyed upon by carnivorous receptors. Inhalation and direct contact by burrowing animals were not evaluated in the ecological risk assessment because data and models have not been developed for ecological receptors.

Subsurface soil is defined at depths of 0.5–10 ft. Contamination depths greater than 10 ft below ground are considered inaccessible to ecological receptors because this depth is generally below the root zone of plants and the burrowing depth of ground-dwelling animals.

Seven ecological COCs were identified based on an HQ greater than or equal to 1 for radionuclides and an HQ of 10 or greater for nonradionuclides. Five of the seven ecological COCs are also human health COCs. The contaminants determined to pose risk to ecological receptors include americium-241, strontium-90, plutonium-240, plutonium-239, cadmium, lead and nitrate.

Ecological risk can be fully addressed by actions implemented to reduce human health risks. Installation of a cap that incorporates a biotic barrier would inhibit plant and animal intrusion into contaminated subsurface soil, protect ecological receptors from long half-lived radionuclides and nonradionuclide contaminants, and reduce human exposures by preventing biotic transport of contamination to the surface.

Table 4-7. Contaminant concentrations and risk levels for sites under institutional control at the Radioactive Waste Management Complex.

Contaminants of Concern	Peak Occupational Risk	Year of Peak Risk	Peak Residential Risk	Year of Peak Risk	Peak Hazard Index	Year of Peak Risk	Pathways
Americium-241	5 in 1,000,000	2951	3 in 100,000	2953	N/A	N/A	Soil ingestion, inhalation, external exposure, and crop ingestion
Carbon-14	2 in 10^{11}	2209	6 in 10,000	2278	N/A	N/A	Groundwater ingestion
Carbon tetrachloride	4 in 1,000	1967	2 in 1,000	2105	50	2105	Groundwater ingestion
Chlorine-36	TBD	TBD	1 in 100,000	2110	N/A	N/A	Groundwater ingestion
Iodine-129	3 in 10^{16}	1970	6 in 100,000	2110	N/A	N/A	Groundwater ingestion
Methylene chloride	5 in 10,000,000	1968	2 in 100,000	2185	0.1	2185	Groundwater ingestion
Neptunium-237	2 in 10^{8}	2664	4 in 10,000	3010	N/A	N/A	Groundwater ingestion
Niobium-94	2 in 100,000	3007	8 in 100,000	3010	N/A	N/A	External exposure
Nitrate	5 in 1,000,000	1999	N/A	N/A	1	2120	Groundwater ingestion
Plutonium-238	2 in 10^{10}	2288	1 in 10^{9}	2286	N/A	N/A	Soil and crop ingestion
Plutonium-239	4 in 10,000,000	3010	2 in 1,000,000	3010	N/A	N/A	Soil and crop ingestion
Plutonium-240	4 in 10,000,000	3008	2 in 1,000,000	3010	N/A	N/A	Soil and crop ingestion
Strontium-90	1 in 1,000,000	2033	1 in 10,000	2110	N/A	N/A	Crop ingestion
Technetium-99	5 in 10^{10}	1971	4 in 10,000	2110	N/A	N/A	Groundwater ingestion and crop ingestion
Tetrachloroethylene	5 in 100,000	1968	2 in 10,000	1968	1	2137	Groundwater ingestion and dermal exposure to contaminated water
Uranium-233	8 in 10^{12}	2972	3 in 100,000	3010	N/A	N/A	Groundwater ingestion
Uranium-234	5 in 10^{10}	3005	2 in 1,000	3010	N/A	N/A	Groundwater ingestion
Uranium-235	2 in 10^{9}	2208	1 in 10,000	2662	N/A	N/A	Groundwater ingestion
Uranium-236	2 in 10^{11}	2217	1 in 10,000	2662	N/A	N/A	Groundwater ingestion
Uranium-238	9 in 10^{9}	2234	3 in 1,000	3010	N/A	N/A	Groundwater ingestion

Source of Information:

Ancillary Basis for Risk Analysis (Holdren et al. 2002)

Second Addendum to the Work Plan for the OU 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study (Holdren and Broomfield 2004)

N/A = not applicable

TBD = to be determined

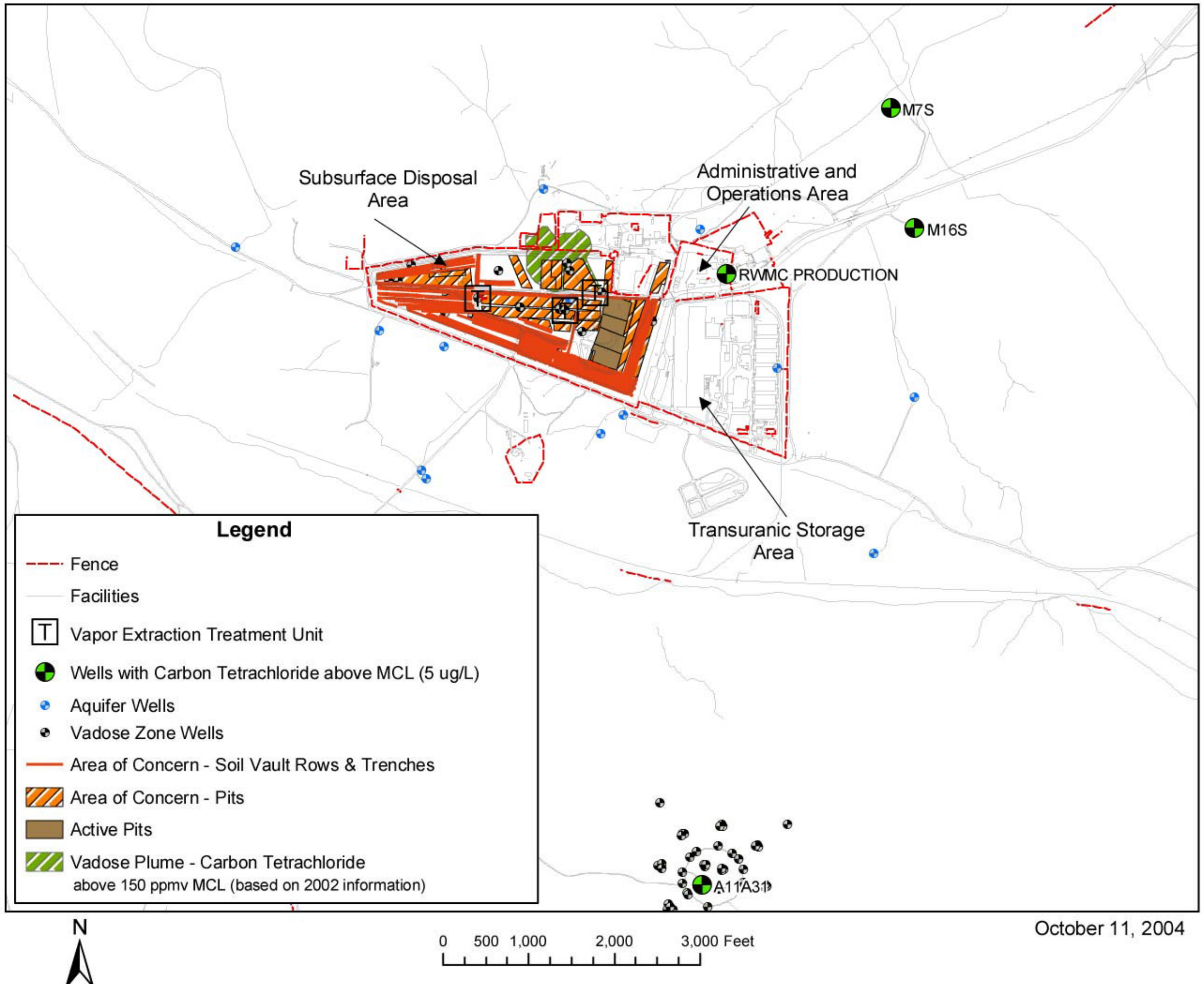

Figure 4-30. Radioactive Waste Management Complex map—current state.

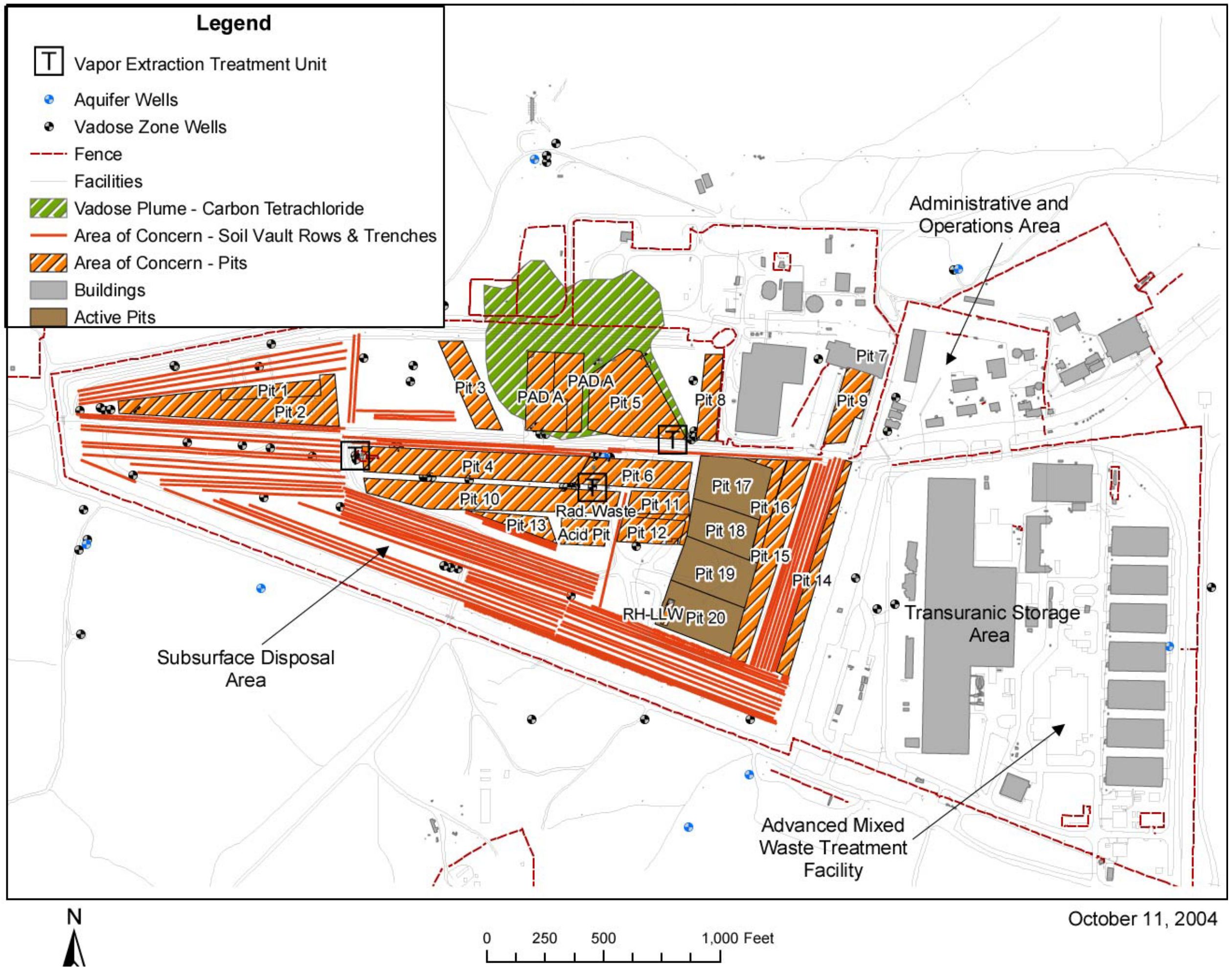

Figure 4-31. Radioactive Waste Management Complex facility detail map—current state.

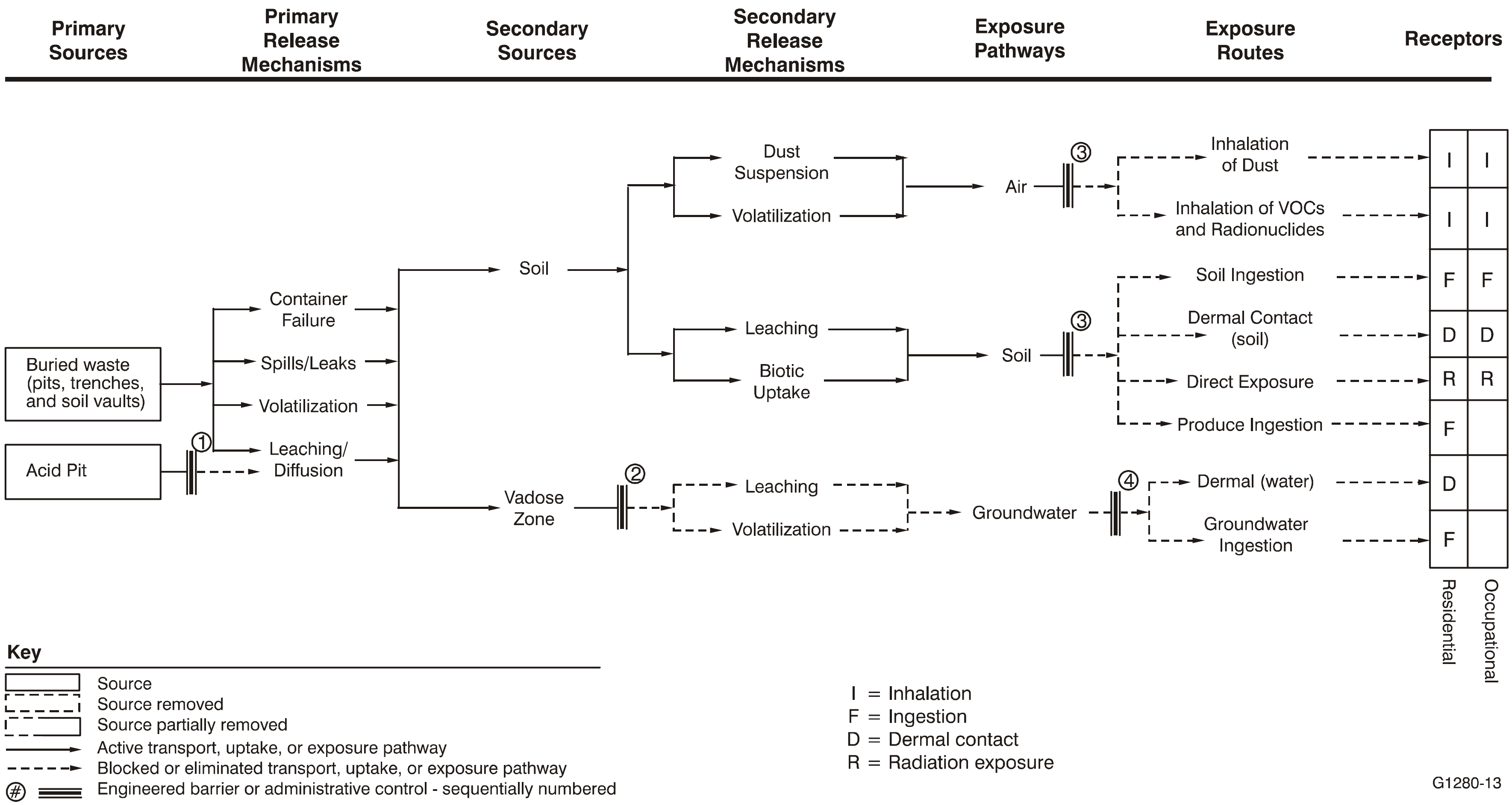

Figure 4-32. Radioactive Waste Management Complex conceptual site model—current state.

Narrative for Figure 4-32 Radioactive Waste Management Complex Conceptual Site Model—Current State

The primary area of concern at the RWMC is the SDA. The SDA is 97 acres in size and consists of 21 pits, 58 trenches, and 21 soil vault rows. The SDA was used as a land disposal facility for radioactive and mixed waste from 1952 through the present. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued in 1983. A portion of the SDA, Pits 17–20, is still active and used for LLW disposal from operations on the INL Site.

Carbon tetrachloride poses the most imminent risk. Carbon tetrachloride has been detected in the aquifer slightly above the MCL and is being extracted from the vadose zone to reduce risk. Mobile long-lived fission and activation products are the next most immediate concern.

Actions and Barriers:

The steps taken to mitigate or remove these hazards are as follows:

1. The Acid Pit received liquid organic and inorganic waste from 1954 to 1961. Some of the waste was contaminated with low-level radioactivity. Typically, liquid waste was poured directly into the pit. Lime was sometimes added to neutralize acids. Closure operations in 1961 included filling the pit with a soil cover to match the local gradient and revegetation. In 1997, as part of a CERCLA treatability study, portions the Acid Pit site were grouted with approximately 3,300 gal of grout. Evaluations subsequent to the grouting treatability study concluded that no further action was warranted. Mercury was eliminated as a COPC for the comprehensive RI/FS, and the Acid Pit was screened from unit-specific consideration in the *Addendum to the Work Plan for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study* (DOE-ID 1998c).

2. A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction with treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. In the spring of 2004, two of the units were replaced with new vapor vacuum extraction units that can extract and treat three times the contaminants as the previous system. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal.

3. The entire INL Site has restricted access to prevent intrusion by the public. In addition, the end state for RWMC and the surrounding area will include restricted industrial surface and groundwater use with appropriate institutional controls to address remaining hazards until such time as acceptable risk levels for unrestricted use are attained. The SDA is surrounded by a security fence. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and implement mitigation measures for planned work activities. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring also are conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and surface water run-off. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA.

4. The entire INL Site has restricted access to prevent intrusion by the public. Other institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. An extensive groundwater-monitoring program is in place at RWMC. Drinking water wells used to supply potable water to the work force are located outside of the SDA and are routinely monitored for water quality. No contamination in the aquifer has been detected beyond the INL Site boundary.

Failure Analysis:

Although failed controls are most likely to be found during the annual assessments, they may be discovered at any time. Subcontractors identifying a failed control will notify DOE Idaho. DOE Idaho will notify the EPA and DEQ within 2 business days after discovery of any major activity inconsistent with the specific institutional controls for a site (e.g., unauthorized well drilling or intrusion into engineered covers) or of any change in the land use or land-use designation of a site addressed in the ROD and listed in the INL CFLUP (DOE-ID 1997a) (e.g., change in land use from industrial to residential). Minor inconsistencies (e.g., signs down or missing) will be resolved as necessary. If minor inconsistencies are identified during the annual assessment, the issue and resolution will be documented in the reports.

If DOE Idaho believes that an emergency exists, DOE Idaho can respond to the emergency immediately before notifying EPA and DEQ and need not wait for any EPA or DEQ input to determine a plan of action. DOE Idaho will identify the root cause of the institutional control process failure, evaluate how to correct the process to avoid future problems, and implement these changes after consulting with EPA and DEQ. Table A-1 (see Appendix A) provides responses to failed control procedures that will be used during DOE Idaho control of the INL Site.

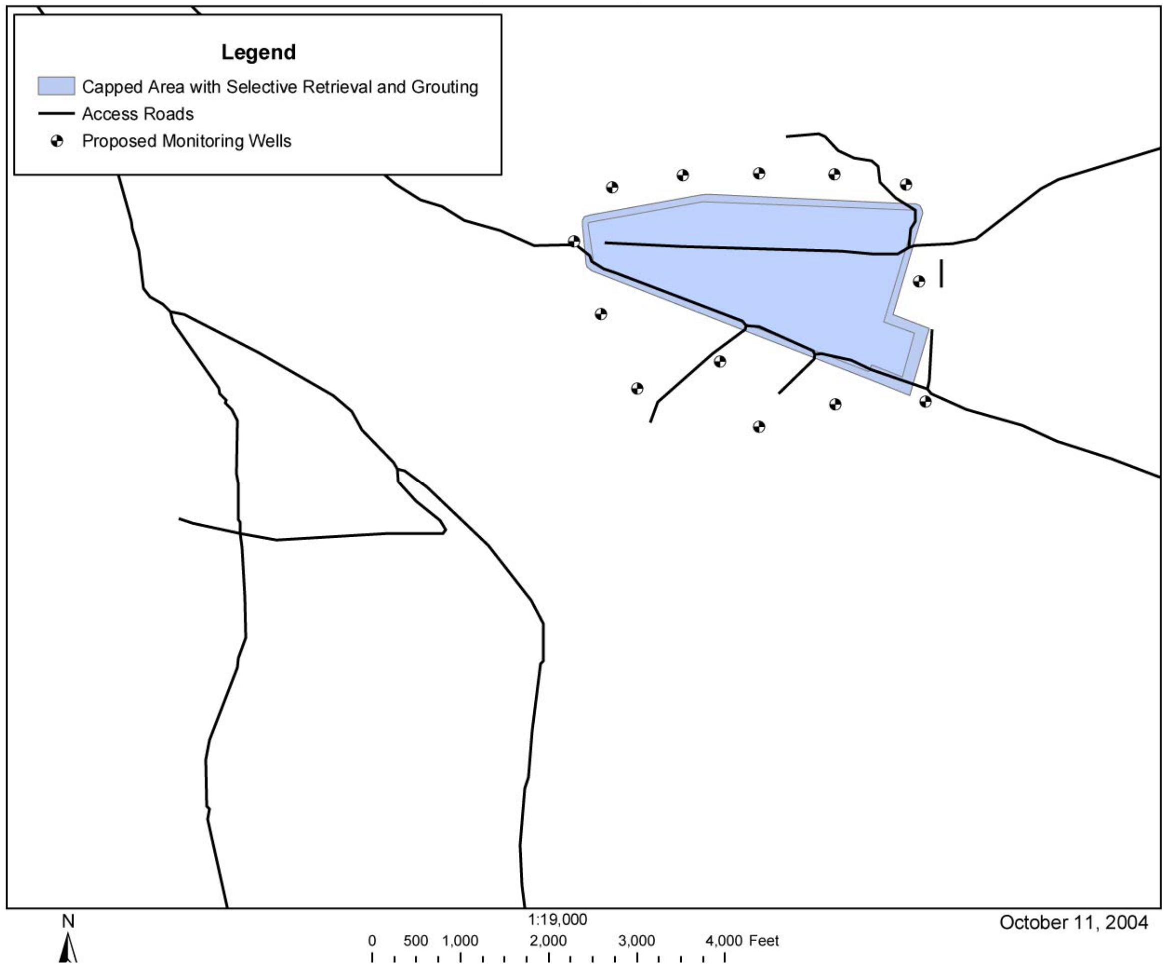

Figure 4-33. Radioactive Waste Management Complex map—end state.

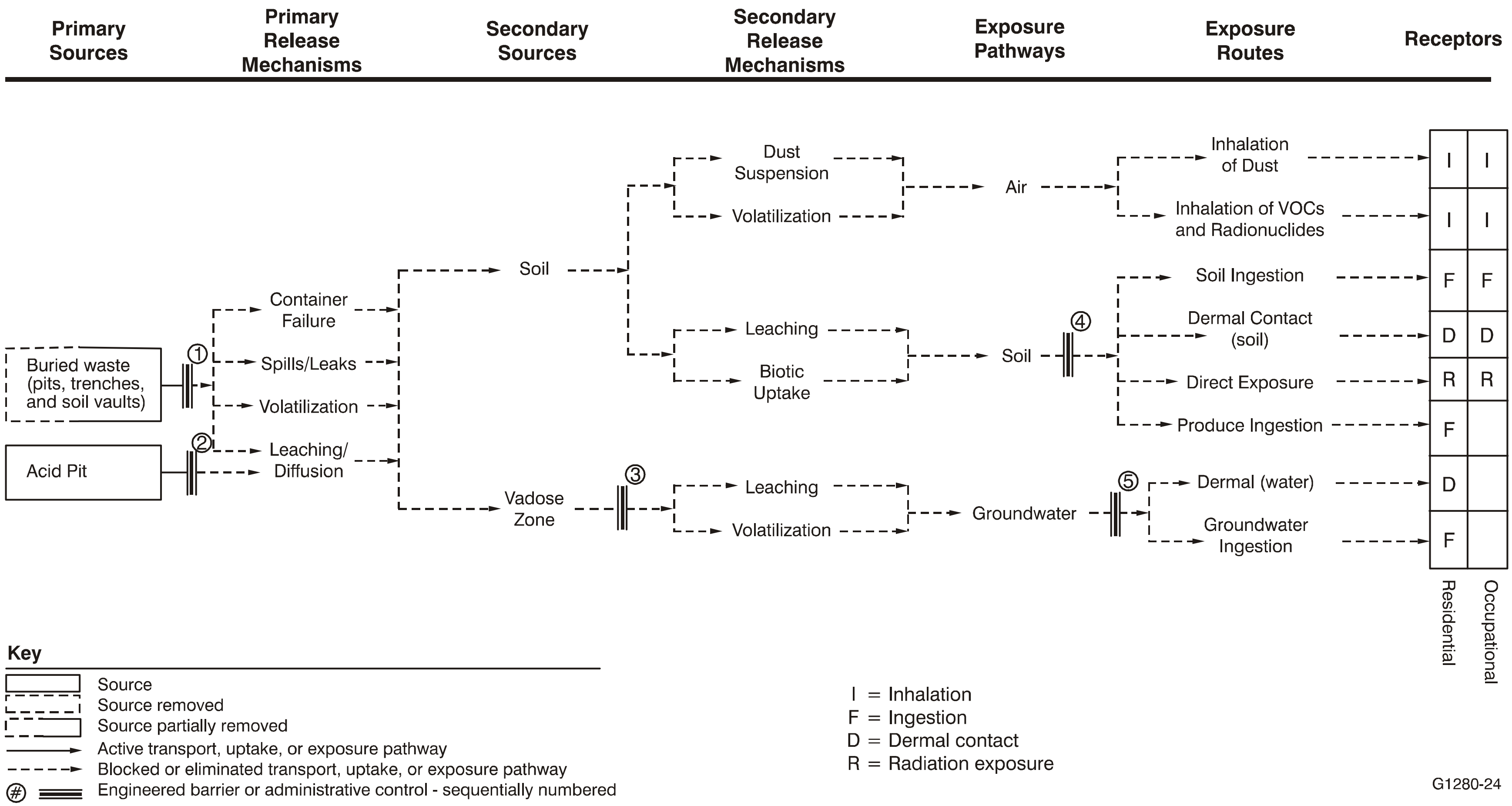

Figure 4-34. Radioactive Waste Management Complex conceptual site model—end state.

Narrative for Figure 4-34 Radioactive Waste Management Complex Conceptual Site Model—End State

The primary area of concern at the RWMC is the SDA. The SDA is 97 acres in size and consists of 21 pits, 58 trenches, and 21 soil vault rows. The SDA was used as a land disposal facility for radioactive and mixed waste from 1952 through the present. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued in 1983. It is anticipated that disposal of LLW in the SDA will be discontinued in 2009.

Carbon tetrachloride poses the most imminent risk. Carbon tetrachloride has been detected in the aquifer slightly above the MCL and is being extracted from the vadose zone to reduce risk. Mobile long-lived fission and activation products are the next most immediate concern.

<u>Actions and Barriers</u>:

The steps taken to mitigate or remove these hazards are as follows:

1. Although the remedial actions for the SDA will not be selected until 2007, it is assumed that any remedy selected will involve some removal of waste and stabilization of some waste through actions such as grouting and that the SDA will be capped with an engineered cover.

2. The Acid Pit received liquid organic and inorganic waste from 1954 to 1961. Some of the waste was contaminated with low-level radioactivity. Typically, liquid waste was poured directly into the pit. Lime was sometimes added to neutralize acids. Closure operations in 1961 included filling the pit with a soil cover to match the local gradient and revegetation. In 1997 as part of a CERCLA treatability study, portions of the Acid Pit site were grouted with approximately 3,300 gal of grout. Evaluations subsequent to the grouting treatability study concluded that no further action was warranted. Mercury was eliminated as a COPC for the comprehensive RI/FS, and the Acid Pit was screened from unit-specific consideration in the *Addendum to the Work Plan for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study* (DOE-ID 1998c).

3. A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration and release through the vadose zone to the aquifer. Additional remedial actions may be identified to remove or stabilize the sources of VOCs in the waste to prevent further leaching to the vadose zone. These actions will be selected in 2008.

4. The entire INL Site has restricted access to prevent intrusion by the public. In addition, the end state for RWMC and the surrounding area will include restricted access with appropriate institutional controls to address remaining hazards until such time as acceptable risk levels for unrestricted use are attained. The SDA is surrounded by a security fence. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring also are conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and releases of surface water run-off. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA. In the event that the DOE mission should end at some unknown time in the future, deed restrictions would be required to prevent intrusion into those areas with residual contamination.

5. The entire INL Site has restricted access to prevent intrusion by the public. Other institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. An extensive groundwater-monitoring program is in place at RWMC. Drinking water wells used to supply potable water to the work force are located outside of the SDA and are routinely monitored for water quality. No contamination in the aquifer has been detected beyond the INL Site boundary. In the event that the DOE mission should end at some unknown time in the future, deed restrictions would be required to prevent intrusion into those areas with residual contamination.

<u>Failure Analysis</u>:

Although failed controls are most likely to be found during the annual assessments, they may be discovered at any time. Subcontractors identifying a failed control will notify DOE Idaho. DOE Idaho will notify the EPA and DEQ within 2 business days after discovery of any major activity inconsistent with the specific institutional controls for a site (e.g., unauthorized well drilling or intrusion into engineered covers) or of any change in the land use or land-use designation of a site addressed in the ROD and listed in the INL CFLUP (DOE-ID 1997a) (e.g., change in land use from industrial to residential). Minor inconsistencies (e.g., signs down or missing) will be resolved as necessary. If minor inconsistencies are identified during the annual assessment, the issue and resolution will be documented in the reports.

If DOE Idaho believes that an emergency exists, DOE Idaho can respond to the emergency immediately before notifying EPA and DEQ and need not wait for any EPA or DEQ input to determine a plan of action. DOE Idaho will identify the root cause of the institutional control process failure, evaluate how to correct the process to avoid future problems, and implement these changes after consulting with EPA and DEQ. Table A-1 (see Appendix A) provides responses to failed control procedures that will be used during DOE Idaho control of the INL Site.